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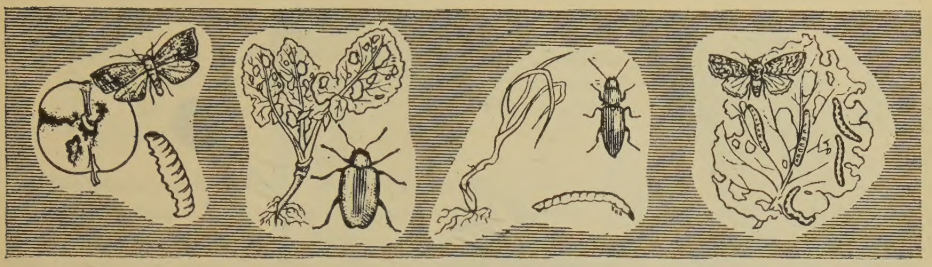

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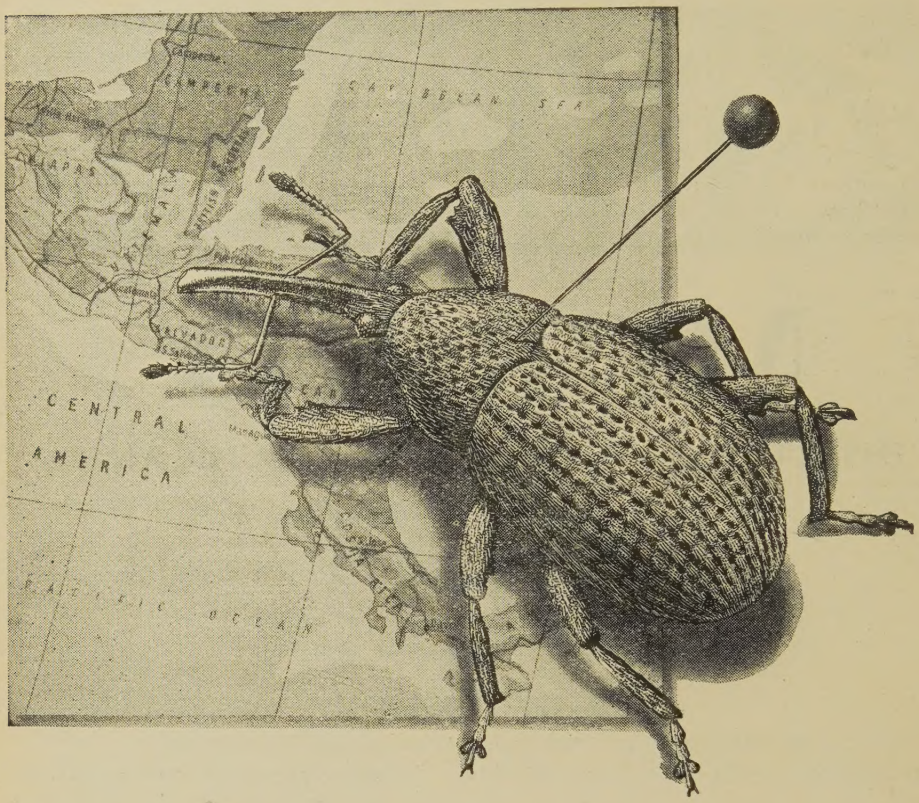

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Fjelddalen (J.). **Skuddtoppmidden** *Hemitarsonemus latus* (**Banks**) **Ewing. Et ødeleggende skadedyr på grønne planter.** [*H. latus*, a destructive Pest of Foliage Plants.]—*Gartneryrket* 1952 no. 30 pp. 527–530 repr. 8 pp., 6 figs., 7 refs. Oslo, 1952. (With a Summary in English.)

Hemitarsonemus latus (Banks) was observed in Norway for the first time in 1949, when *Cissus*, *Hedera* and other plants in glasshouses in and near Oslo were found to be infested. The mite and its eggs are briefly described, its bionomics and the damage caused by its feeding on shoots and young leaves is reviewed from the literature, and experiments on control are summarised. A parathion spray was first tested, but though 2–3 applications reduced the infestation, control was not complete. Smokes were used in subsequent tests, these being released from tablets containing 20 per cent. of a mixture of parathion and methyl-parathion adsorbed on activated charcoal or from containers holding a mixture incorporating 13 per cent. γ BHC. The tablets were used at the rate of one per 100 cu. m. space, and the containers at one per 230–340 cu. m. When applied three times at 12-day intervals at a temperature of 16–25°C. [60·8–77°F.], BHC gave complete control [*cf. R.A.E.*, A **41** 6], but the parathion mixture was unsatisfactory. Neither treatment injured the plants. In further tests, two BHC treatments a week apart gave complete control on heavily infested plants, but one was insufficient, and similar results were obtained in practical work in 1951–52.

Ebbe-Nyman (E.). **Rapsjordloppan** *Psylliodes chrysocephala* **L. Bidrag till kännedom om dess biologi och bekämpning.** [The Rape Flea-beetle. A Contribution to Knowledge of its Bionomics and Control.]—*Medd. Växtskyddsanst.* no. 63, 103 pp., 14 figs., 44 refs. Stockholm, 1952. (With a Summary in English.)

The following is based on the author's summary of this account of investigations in southern Sweden in 1949–51 on the bionomics and control of *Psylliodes chrysocephala* (L.) on rape. They were rendered necessary by the great increase of cultivation of winter rape after 1940 and a succession of mild winters, which permitted the flea-beetle to increase to outbreak numbers and cause great damage to the crop. Winter rape shows above the ground during August, and the first larvae were observed about 27 days later in 1950. They occurred in the two lowermost petioles until October and overwintered mainly in the first or second instar in petioles higher up the plants. In 1949, however, overwintering occurred as full-fed larvae. Mines in the stems were rare before winter but common after it. The adults emerged between mid-June and mid-July and fed on the plants, but soon migrated to summer quarters, owing to excessive heat and exposure to the sun. They returned to rape fields to oviposit in August and September and began to die off in October, though a few survived the winter in sheltered sites. Flight occurred before but not after overwintering, and the circumstances in which it was observed are discussed.

Experiments on the control of the flea-beetle were carried out in both laboratory and field. In the latter, poor results were given by soil treatment with DDT, but a 25 per cent. BHC dust harrowed into the soil at the rate of 13·5 lb. per acre at the time of sowing resulted in 90 per cent. reduction of larvae five months later. This was the only material that showed much toxicity to the larvae, though a preparation of the parathion type proved effective against those in the first instar.

(1856) Wt. P8522/3895 7/55 E.P. Ltd. Gp. 566. [A]

Roehrich (R.). **Le parasitisme naturel de la tordeuse du pêcher** (*Laspeyresia molesta* **Busck**) **dans le sud-ouest de la France** (**Lep. Olethreutidae**). —*Bull. Soc. ent. Fr.* **59** no. 1–2 pp. 14–16, 6 refs. Paris, 1954.

A survey of the indigenous parasites that attack *Cydia* (*Laspeyresia*) *molesta* (Busck) was made in orchards in three localities in south-western France in 1944–52. Those obtained from the larvae comprised the Ichneumonids, *Agrypon anxium* (Wesm.), *Ephialtes* (*Epiurus*) *elegans* (Woldst.), *Pristomerus vulnerator* (Panz.) and a species identified by Granger as *Lissonota transversa* Bridgm. [*cf. R.A.E.*, A **42** 63], the Braconids, *Ascogaster quadridentata* Wesm., *Eubadizon extensor* (L.), *Macrocentrus dorsalis* (Spin.), and *Meteorus* sp., and the Tachinid, *Zenillia roseanae* (B. & B.) (*Pseudoperichaeta insidiosa*, auct.). In the locality in which the percentage parasitism was highest, it averaged 8·4 in 1949 and 4·6 in 1951, with maxima of 18·6 in June in the first year and 9·1 in July in the second. Of the Hymenoptera, only *Pristomerus* was at all numerous, and the others were rare, except for *Eubadizon*, which was reared only from larvae on medlar. Only the Tachinid was obtained after the end of July. *Trichogramma* sp. parasitised 20 per cent. of the eggs of the moth on pear in one locality in September 1951, but no adults emerged. These results are compared with those obtained in south-eastern France in 1930–31 [**22** 192], and it is concluded that no native parasite has yet become fully adapted to *C. molesta*. *Macrocentrus ancylivorus* Rohw., which parasitises *C. molesta* in the United States, was obtained from California and released in orchards and nurseries near Bordeaux in 1951, but was not recovered in the following year.

Mushroom Growing.—*Bull. Minist. Agric.* no. 34 (6th edn.), iv + 79 pp., 22 pls., 2 figs., 4 pp. refs. London, H.M.S.O., 1954. Price 5*s.* 0*d.*

The section on pests, mostly insects and mites, in this edition of a bulletin on the cultivation of mushrooms in Britain [*cf. R.A.E.*, A **39** 79] has been partly revised, with the introduction of information on the use of recent methods of control.

Borror (D. J.) & DeLong (D. M.). **An Introduction to the Study of Insects.**—9¼ × 6¼ ins., ix + 1030 pp., 634 figs., many refs. New York, N.Y., Rinehart & Co., 1954. Price $9.

This text-book for students is primarily concerned with the classification and identification of insects. Three introductory chapters deal briefly with insect anatomy and development and the elements of classification, nomenclature and identification. The bulk of the book is composed of keys to the different orders and to the families of insects represented in the United States, all based on the adults, with notes on the general appearance, habitats and habits of the different families and on some individual species of economic or other interest. Other arthropods are treated similarly but more briefly and four concluding chapters review the ways in which insects are beneficial or harmful to man, methods of collecting and preserving insects and of controlling harmful ones, and techniques and apparatus for use in special studies.

Rose (G. J.). **Crop Protection.**—$8\frac{3}{4} \times 5\frac{1}{2}$ ins., xxi + 223 pp., col. frontis., 62 pls. (6 col.), 15 figs. London, L. Hill Ltd., 1955. Price £1 10*s*.

This handbook on the application of chemical control for the protection of plants against insects and other animal pests, diseases and weeds is primarily concerned with crops characteristic of the temperate regions, but *Citrus*, coffee, cotton, sisal, sugar-cane and tea are also included. The first of the four main sections into which it is divided opens with a summary of cultural methods, after which the various types of formulation in which insecticides and other toxic materials used in plant protection are available and the factors to be considered in their selection are discussed. The second section contains information on the nature, formulations, and uses of the compounds most commonly employed on a commercial scale, and the third, descriptions of a wide range of equipment for their application, mainly from the ground, and information on selection, operation and maintenance. The fourth section comprises a summary of measures for the protection of stored products and the premises containing them, to which a review of measures against specific pests and diseases of various crops is appended.

Zagulyaev (A. K.). **On the Biology of the Clothes Moth (*Tineola biselliella* Humm.) and of a new Species—the Furniture Moth (*Tineola furciferella* Zagulajev, sp.n.).** [*In Russian.*]—*Trud. zool. Inst. Akad. Nauk SSSR* **15** pp. 154–169, 5 figs., 21 refs. Moscow, 1954.

Investigations in the Soviet Union showed that two species have been included under the name *Tineola bisselliella* (Humm.), the true *T. bisselliella* and one distinguished from it by the darker colour of the wings, its larger size, its long maxillary palps, the structure of the male genitalia, and its bionomics. The latter is described from adults of both sexes as *T. furciferella*, sp. n. The description is based on material collected in living quarters, warehouses and wool-carding factories situated in the Provinces of Moscow, Ul'yanov, Gor'kiĭ, Leningrad and Stalingrad, and museum specimens from other districts and from France were also examined. *T. furciferella* is widely distributed in the central zone of the Soviet Union, where it greatly outnumbers *T. bisselliella* and is an important pest of furs, pelts and wool. It tends to appear in outbreak numbers, and an outbreak in the autumn of 1951 caused serious damage to soft furnishings in a hotel in Moscow.

The morphological characters of the immature stages of the two species are compared, and an account is given of investigations on their bionomics carried out in 1948–52. Under laboratory conditions, *T. furciferella* had 2–4 generations a year, the duration of development from egg to adult ranging from 65 days at 23°C. [73·4°F.] to 193 at 15°C. [59°F.]. Death occurred in the first instar at 10°C. [50°F.] and in the second at 27°C. [80·6°F.]. The females laid 100–300 eggs each, in batches of 2–20 in carefully selected sites on the food medium. *T. bisselliella* had only one generation a year or one and a half, development from egg to adult requiring at least 300 days, and the females laid 60–110 eggs each, scattering them at random on the substrate, to which they adhered. In winter, at 15–17°C. [59–62·6°F.], the eggs of *T. furciferella* hatched in 11–14 days and those of *T. bisselliella* in 16–21. The larvae of the former passed through 6–8 instars, and those of the latter through 14–17.

The habits of the larvae were observed on pelts. Larvae of *T. furciferella* fed on the surface layer of the skin, the roots of the hairs and the fur itself, each spinning a silken case into which food remains and excreta were woven. As feeding progressed, the case became longer, finally reaching a

length of up to 4 ins. Sometimes the larva abandoned its case and spun another in a different place. The larvae of *T. bisselliella* fed openly on the surface of the skin under a light web made by joining the ends of the cut hairs together, and readily moved to different sites within distances of 4–8 ins., one larva thus damaging a pelt in several places. Though a larva of *T. bisselliella* consumed more during its life than did a larva of *T. furciferella*, the cumulative loss caused by the latter species is considerably greater, owing to its higher reproductive rate. In experiments with different substrates, the results of which are shown in a table, batches of ten larvae of *T. furciferella* in the first and fifth instar were transferred to musquash, fox fur, feathers, sheepskin, wool yarn, woollen cloth, dried insects and felt, and with the exception of a few larvae of the first instar all survived and gave rise to adults. The duration of the development and the size and weight of the larvae varied with the kind of food, the first-instar larvae becoming full-fed in 72, 80, 90, 91, 115, 116–117, 120–151 and 142–150 days, respectively. Larvae approaching maturity withstood starvation for up to 30 days, and those of *T. bisselliella* for up to 40–50. Larvae of *T. furciferella* pupated in cocoons, usually at the end of their cases, and the pupal stage lasted 7–18 days. Those of *T. bisselliella* pupated either in cocoons outside the web or lying free under the web, and the pupal stage lasted 8–29 days in general, though it was occasionally prolonged to 2–5 months. Fertilised females of both species lived for 8–17 days and oviposited throughout life. Attempts to cross the two species were not successful.

Aleeva (M. N.). **Data on the Biology of Weevils (Coleoptera, Curculionidae) injurious to Sugar Beet in Kazakhstan.** [*In Russian.*]—*Ent. Obozr.* **33** pp. 103–108, 8 refs. Moscow, 1953.

Sugar beet in southern Kazakhstan is attacked by over 20 species of weevils. Of those not known to infest it elsewhere, *Ulobaris loricata* (Boh.) [*cf. R.A.E.*, A **27** 152], *Cleonus* (*Bothynoderes*) *subfuscus* (Faûst) and *C.* (*Chromoderus*) *confluens* Fhs. are the most important. Observations in 1945–46 showed that *U. loricata* was common in the hot, dry northern districts on wild species of *Amarantus* and chenopodiaceous plants and caused serious injury to sugar beet in dry places at the foot of the mountains. Both larvae and adults overwintered, and the spring period of transformation and emergence was very protracted, pupae being found as late as 20th July in a plot of beet grown for seed. The adults remained in the soil during the day, penetrating deeper as the temperature rose. At the end of July, when the temperature was 58·5°C. [137·3°F.] at the soil surface, they occurred at depths of 7–9 ins., where it was only 29·8°C. [85·64°F.]. In the soil they moved only in a vertical direction close to their food-plants, gnawing out small pits in the roots and underground parts of the stems. In the evening, they came to the surface and fed on the petioles and other aerial parts. Pairing occurred in the soil after a period of feeding, and eggs were laid from the end of May to the beginning of September, chiefly at the bottom of the feeding pits but sometimes on the uninjured root surfaces. The larvae hatched in 7–10 days and burrowed into the roots, as many as 100 being observed in some. Severe infestation caused the leaves to wither and the roots to dry up in dry soil. The duration of development from egg to adult depended on soil temperature and humidity, and was 50–60 days in elevated parts of a field, well heated by the sun. Pupation occurred in cells in the feeding galleries. The larvae were parasitised throughout the summer by *Anisopteromalus* (*Aplastomorpha*) sp., which had one generation a year. Usually 12–20 parasite

larvae developed in a single larva of the host, and they pupated in it, both larvae and pupae hibernating and the adults emerging between the beginning of May and the end of July.

C. subfuscus, which is widely distributed in the beet-growing regions of Kazakhstan, was the most numerous of the weevils observed. It had one generation a year, development from egg to adult lasting 70–75 days and the adults hibernating in earthen cells in the soil. They emerged early in spring, before weeds were present, and fed on sprouting early-sown sugar beet, often destroying the germinating seedlings. Later, they also fed on wild plants. Pairing and oviposition began in mid-May and continued throughout the summer, eggs being laid in the soil at the roots of the food-plants. The eggs were parasitised by *Xenocrepis* sp., complete development of which lasted 7–8 days, and the percentage parasitised reached 42·5 in some fields in 1946. The young weevil larvae fed on the surface tissues of the roots and gradually moved lower in the soil; the older ones gnawed fairly deep pits and sometimes cut the lower part of the taproot, causing the development of side roots, the market value of which is low. The number of larvae per plant reached 15–20 on dry land. Pupation occurred at depths of 4–8 ins., and the adults emerged in August.

C. confluens usually constituted 16–20 per cent. of all the weevils found infesting sugar beet. The overwintered adults appeared in early spring together with those of *C. subfuscus*, were most numerous at the end of May and the beginning of June, and fed on the leaves of beet and *Salsola kali*. Pairing and oviposition occurred from mid-May until the second half of June, the eggs usually being laid on the exposed parts of the roots and on the leaf-stalks. In 1946, over 80 per cent. of the eggs in some fields were parasitised by *Xenocrepis* sp. The larvae entered the soil and fed on the roots of the plants.

In addition, information is given on the life-history of *Pachycerus madidus* (Ol.), which was numerous in one district in 1946 in fields of sugar beet in which *Heliotropium dasycarpum* was a common weed. Development occurred exclusively on the latter, but the adults occasionally fed on the leaves of the beet.

Kozhanchikov (I. V.). **Two new Fruit-infesting Species of** *Laspeyresia* (*Grapholitha*) **injurious to the Fruits of cultivated Rosaceae in eastern Siberia.** [*In Russian.*]—*Ent. Obozr.* **33** pp. 109–122, 5 figs., 30 refs. Moscow, 1953.

The two new species referred to are *Cydia* (*Laspeyresia*) *prunifoliae* and *C.* (*L.*) *cerasana*, which were taken infesting the fruits of apple and cherry, respectively, in Transbaikalia in 1949. Descriptions of the adults of both sexes are given, together with a review of the food-plant relations of these and other species of the group.

Fal'kovich (M. I.). **Tortricid Shoot Moths** *Evetria* **Hb. (Lepidoptera, Tortricidae) of the Buzuluk Pine Forest.** [*In Russian.*]—*Ent. Obozr.* **33** pp. 123–127, 8 refs. Moscow, 1953.

Observations in the summer of 1952 in a large pine forest in the south-east of European Russia showed that the species of *Rhyacionia* (*Evetria*) present were *R. turionana* (Hb.), which was the commonest, *R. duplana* (Hb.), *R. buoliana* (Schiff.), and *R. resinella* (L.), which was rare. The larvae of *R. turionana* fed at the base of the central and side buds on the May shoots, but the injury did not become noticeable until August, when droplets of

resin appeared. As a result of the infestation, the tips of the shoots frequently died. The larvae hibernated when full-fed, pupated in spring and gave rise to adults in May, the flight continuing till the beginning of June. *R. duplana* was less important. The adults were taken from 4th to 11th May, and the larvae occurred on the May shoots, 3–7 to each, at the end of the month. Infestation arrested the normal development of the shoots, and the tips frequently died. About mid-June, the larvae entered the bark near the root collar and pupated, but the process was very protracted, cocoons containing larvae being found as late as 5th August, when many of the adults were already fully formed. *R. buoliana* was commonest in mature stands, and its importance lay in the fact that the larvae fed on the buds of the male flowers, thus reducing the production of pollen and the yield of cones.

Control of *R. turionana* was considered necessary, and since laboratory experiments in 1951 indicated that DDT and BHC were both effective against the adults of these Tortricids, a dust containing 12 per cent. BHC was applied from an aeroplane at the rate of 18 lb. per acre on 27th May to 65 acres of forest, and one of 5·5 per cent. DDT dust at the same rate to some 19 acres on 30th May. The results were estimated by comparing the numbers of adults taken on sample plots 100 sq. metres in area before and 24 and 48 hours after dusting. Both dusts proved very effective, the number of moths per plot falling from 396–523 before treatment to 1–4 after 24 hours and 0 after 48. The whole of the dusted area was examined on 21st August, and infestation by the larvae was found to be only one quarter of that in the adjoining untreated parts. In view of the shortness of the period during which the adults are present, dusting would best be carried out immediately before they emerge.

Skorikova (O. A.). **Contribution to the Biology of Sawflies (Hymenoptera, Tenthredinidae) injurious to Currant and Gooseberry in the Province of Leningrad.** [*In Russian.*]—*Ent. Obozr.* **33** pp. 128–131, 1 fig., 4 refs. Moscow, 1953.

Descriptions are given of the adult female and larva of *Eriocampa dorpatica* Konow (the male of which is unknown) and of the adults of both sexes and larva of *Nematus* (*Pteronidea*) sp., which are important pests of bush fruits in the Province of Leningrad and adjoining districts. *E. dorpatica* attacks wild and cultivated black currant and occasionally red currant, though this is an unfavourable food-plant, and *Nematus* sp. infests red currant and sometimes gooseberry [*cf. R.A.E.*, A **43** 110]. Both have one generation a year. The eggs of *E. dorpatica* are laid singly on the leaves at the beginning of June, and the larvae feed on the lower surfaces from the second half of July until the beginning of September. Pupation occurs in the soil. Densely growing bushes suffer most, up to 80 per cent. of the leaves being infested, whereas well separated bushes growing in open sites exposed to the sun are seldom attacked. The adults of *Nematus* sp. are similar to those of *N.* (*P.*) *ribesii* (Scop.) and have been considered to represent a dark variety of it. Differences between the two species are pointed out. The adults emerge 15–20 days before those of *N. ribesii*, and the eggs are laid singly or in groups of 2–7 on the leaves of red currant at the time when these are expanding. The larvae feed on the edges of the leaves, including the veins, and pupate in the soil among the roots.

Tsvetkova (V. P.). **Contribution to the Biology of the Termite** *Reticulitermes luciphugus* **Rossi (Isoptera).** [*In Russian.*]—*Ent. Obozr.* **33** pp. 132–141, 4 figs., 19 refs. Moscow, 1953.

Reticulitermes lucifugus (Rossi) has long been known in the south of European Russia and has been recorded as destructive to timbers in buildings in Odessa and as far north as Dnepropetrovsk. It also attacks living plants. Observations on natural and laboratory colonies of the termite were made in Odessa in 1937–40, and the results are described in detail, with notes on the various forms observed, the habits of the termites, and the collection of the nests. In 1937, mass swarming, which lasted only one day, took place in early May. The growth of a colony depended primarily on temperature and humidity. The termites were very active, built galleries and propagated at an average temperature of 20–22°C. [68–71·6°F.], but activity decreased as the temperature dropped to 10°C. [50°F.] and ceased at 5°C. [41°F.]. When the moisture content of the nest walls fell to 6–9 per cent., the termites emerged on to the surface, where they eventually died.

Münster (J.). **Étude de la multiplication de** *Rhopalosiphoninus latysiphon* **Davids. sur les tubercules de pommes de terre plantés dans des terres de structures diverses.**—*Landw. Jb. Schweiz* **67** pt. 6 pp. 929–934, 3 figs., 9 refs. Berne, 1953.

In 1952, studies were made in a greenhouse on the asexual reproduction of *Rhopalosiphoninus latysiphon* (Davidson) on potatoes growing in various types of soil. This Aphid, which may be of some importance as a virus vector [*cf. R.A.E.*, A **41** 183], occurs widely on stored potato tubers in Switzerland, though it has not been observed there on the aerial parts of the plants in the field [*cf.* **39** 419; **40** 397]. Tubers were planted on 4th January in pots containing soil of five types, ranging from leaf mould to clay, and five Aphids, reared on tulip leaves, were placed on the sprouts of each. The temperature of the soil was 12–17°C. [53·6–62·6°F.]. Observations on the Aphid populations were made as far as possible 38, 59 and 147 days after planting, and the results are given in a table. On the last date, when the time elapsed was that normally required for a medium-late crop to mature, flourishing Aphid colonies were present on the underground parts of one of two plants in potting compost, and one of two in clay loam. Two alates were seen on the plants 25 days after the beginning of the observations, but Aphids placed on the haulms did not reproduce, though the temperature was favourable. It is concluded that *R. latysiphon* can maintain itself on the underground parts of potato in both light and heavy soils long enough to be re-introduced into storerooms with the new crop.

Geier (P.) & Murbach (R.). **Influence des populations larvaires de** *Melolontha melolontha* **L. (Coléop. Scarab.) sur le rendement des céréales et des pommes de terre.**—*Landw. Jb. Schweiz* **67** pt. 6 pp. 935–939, 2 graphs, 2 refs. Berne, 1953.

Preliminary studies were made in Switzerland in 1952 on the effect of infestation by third-instar larvae of *Melolontha melolontha* (L.) on the yield of autumn wheat, oats and potatoes. Populations were estimated by the examination of soil samples taken to depths of 8–12 ins. at harvest in plots in fields in various localities, and these were compared with the yields obtained from the plots. The yields of autumn wheat were in general lowest from the plots with the largest populations of larvae, but showed no

variation with populations of less than 10–15 per sq. metre, the effect being masked by other factors. Straw yield was not affected. There was no relation between yields of oats and larval populations except possibly when the latter exceeded 50 per sq. metre, other factors, including attack by *Oscinella frit* (L.), the date of sowing and varietal differences, obscuring the effects of infestation. The total weight of potato tubers harvested was not affected by the population level of the larvae, but the weight of damaged tubers varied more or less directly with it over the range of population found, which was 2–14·5 larvae per sq. metre.

Geier (P.), Mathys (G.), Murbach (R.) & Weber (A.). **Estimation des populations de vers de la grappe** (*Clysia ambiguella* **Hb. et** *Polychrosis botrana* **Schiff., Lép. Tortric.).**—*Landw. Jb. Schweiz* **67** pt. 6 pp. 953–958, 1 graph, 3 refs. Berne, 1953.

Observations in Switzerland in May and June 1952 showed that the distribution of the larvae of *Clysiana* (*Clysia*) *ambiguella* (Hb.) and *Lobesia* (*Polychrosis*) *botrana* (Schiff.) throughout a vineyard depended largely on the numbers of inflorescences per plant, since the eggs of the first generation are laid exclusively on these. For the purpose of sampling, groups of four plants should be examined, the differences between groups of two or single plants being excessive. For determination of the numbers of larvae per plant, a coefficient of variation of 20 per cent. is considered sufficiently accurate, and this was obtained by sampling ten groups of four plants in a vineyard containing 8,000 vines. To obtain a coefficient of 10 per cent., about four times as many plants must be examined, and this greater degree of accuracy is unnecessary except possibly for estimating the control given by insecticides over very small areas.

Geier (P.) & Baggiolini (M.). **Observations sur la tordeuse orientale du pêcher** (*Laspeyresia molesta* **Busck) en Suisse romande et italienne.**—*Landw. Jb. Schweiz* **67** pt. 6 pp. 971–980, 6 figs., 15 refs. Berne, 1953.

Much of the information in this account of investigations begun in 1951 on *Cydia* (*Laspeyresia*) *molesta* (Busck) on peach and other fruits in the Ticino and Vaud has already been noticed [*cf. R.A.E.*, A **42** 63]. Records of the seasonal development of the moth in 1951–52 showed that in the Ticino, adults of the overwintered generation were observed from 1st–10th May, infestation of the twigs by first-generation larvae from 15th–20th May, heavy attack on the twigs by second-generation larvae from 10th–20th June, infestation of peach fruits by the second-generation larvae from 15th June, heavy attack on peaches by third-generation larvae from between 25th July and 10th August, infestation of pears by third-generation larvae from 25th July, and heavy infestation of pears by larvae of the third and fourth generations from 10th–15th September. The corresponding dates in Vaud were about a fortnight later in each case. The overwintering larvae were generally of the third and fourth generations, but some second-generation larvae taken in trap-bands in Vaud had already entered diapause. A dusk temperature of at least 15°C. [59°F.] appeared necessary for oviposition. *Lissonota buolianae* Htg. affords important control of the overwintering larvae in Vaud [*cf.* **42** 64], and it parasitised 72 per cent. of those in trap-bands at the end of 1952. Larvae parasitised by this Ichneumonid were first observed at the end of July, and oviposition by it continued until

September. It was itself parasitised to an unimportant extent by *Perilampus tristis* Mayr. The parasites reared from the summer larvae in Vaud comprised *Angitia* sp., *A. rufipes* (Grav.), *A. tenuipes* (Thoms.), *Apanteles anarsiae* Faure & Alabouvette, and *Pristomerus vulnerator* (Panz.), total parasitism reaching 6 per cent. The only parasites observed in the Ticino were *Dibrachys cavus* (Wlk.) and two unidentified species of Diptera, and the rate of parasitism did not exceed 4 per cent.

Mathys (G.). **Observations sur la mobilité des larves néonates de *Quadraspidiotus perniciosus* Comst. et sur leur transport par le vent.**—*Landw. Jb. Schweiz.* **67** pt. 6 pp. 981–984, 2 figs., 9 refs. Berne, 1953.

Laboratory tests in Switzerland showed that crawlers of *Quadraspidiotus perniciosus* (Comst.) move at an average rate of just under an inch per minute on smooth paper, but at only 0·2 inch per minute on blotting paper, so that they would theoretically be able to cover distances of some 60 ft. or more under favourable conditions during the mobile phase [*cf. R.A.E.*, A **30** 612]. When 350 crawlers were released in the centre of a circular sheet of smooth paper divided into seven segments, each of which had a barrier of adhesive at a different distance from the centre, 109 reached the outer barrier, 28 ins. from the centre. When the paper was sprinkled with fine sand, 12 travelled 4 ins., three 8 ins., and the rest 2 ins. or less, thus confirming in general the observations recorded by Melis [**41** 341]. Apple shoots protruding through smooth paper did not attract the crawlers.

In studies on transport by wind, sections of heavily infested branches were left in front of a fan for 30 minutes and the crawlers collected on a sticky screen placed 12–16 ins. away. At wind speeds of 8·9, 6·7, 4·5 and 2·2 miles per hour, those taken represented 36, 10–13, 4–6 and 1–2 per cent. of the original populations, respectively, and the results were similar at the lowest wind speed even when the exposure period was 48 or 72 hours. No crawlers were carried by winds of 1·8 miles per hour, and temperature and relative humidity had little effect on carriage. In the field, 245 crawlers were collected in ten hours on a screen about a yard square placed some 10 ft. from an infested dwarf tree when the maximum wind speed was 6·7 miles per hour.

Rota (P.). **Contributo alla conoscenza degli stadî ibernanti di *Quadraspidiotus* (*Aspidiotus*) *perniciosus* Comst.** [A Contribution to Knowledge of the overwintering Stages of *Q. perniciosus*.]—*Boll. Zool. agr. Bachic.* **19** fasc. 2 pp. 77–84, 1 fig., 1 fldg. pl., 17 refs. Milan, 1953.

Investigations on the stages in which *Quadraspidiotus perniciosus* (Comst.) overwinters in Lombardy were made on apple, pear and peach in 1951–52 at places representative of the local climatic range. At Desenzano, where the climate is the mildest, first-stage nymphs formed the vast majority of the individuals present on 15th November 1951, the others being mature or immature females. At the end of winter, in late January and early February 1952, first-stage nymphs were present in all areas, accompanied by smaller numbers of mature females in the milder ones and a few second-stage females or, still more rarely, males in the mildest. The mature females all died by the end of March, without reproducing in spring, and it is concluded that only the first-stage nymphs successfully survived the lowest winter temperatures [*cf. R.A.E.*, A **37** 457].

Grandori (R.). **Esperimenti di lotta contro insetti dannosi mediante toxafene.** [Experiments on the Control of injurious Insects with Toxaphene.]—*Boll. Zool. agr. Bachic.* **19** fasc. 2 pp. 85–91, 1 ref. Milan, 1953.

Tests with toxaphene for the control of various crop pests were carried out in northern Italy in 1952. Except where otherwise stated, the sprays used contained 0·2 per cent. toxaphene in emulsion form or 0·3 per cent. in a wettable powder. Treatment of cherry trees with the emulsion spray on 28th May, when infestation by *Rhayoletis cerasi* (L.) was beginning, reduced the percentage infestation of the fruits by 12th June to 17 on the higher branches and 12 on the lower ones, as compared with 67 for no treatment. Sprays of 0·3 and 0·5 per cent. toxaphene in the wettable powder applied on 7th September to pear trees heavily infested by *Stephanitis* (*Tingis*) *pyri* (F.) gave 97 and 98 per cent. mortality in five days, and 0·18 or 0·27 lb. actual toxaphene in 27 gals. suspension spray per acre gave 95 and 100 per cent. mortality of larvae of *Laphygma exigua* (Hb.) during an outbreak on lucerne [*cf. R.A.E.*, A **43** 86]. When treatments were applied on 27th May against the first generation of *Clysiana* (*Conchylis*) *ambiguella* (Hb.) and *Lobesia* (*Eudemis*) *botrana* (Schiff.) on vines, or on 27th May against the first generation and on 21st July against the second, the percentages of bunches infested at picking on 11th October were 11·33 and 4·2 for one and two applications of the emulsion spray and 11·1 and 3·3 for one and two of the wettable-powder spray, respectively, as compared with 50·5 for no treatment. The same two sprays applied to apple or pear six times between 20th May and 17th August reduced the percentages of fruits infested by *Cydia pomonella* (L.) to 35·7 and 38·5, respectively, on 3rd September, as compared with 67·2 for no treatment, and the occurrence of two complete generations of the moth in 1952 instead of one and a partial second is held responsible for the rather poor results obtained, the number of applications being insufficient. Damage by *Paratetranychus pilosus* (C. & F.) was severe on apple trees sprayed with arsenicals, but the mite was absent from trees treated with toxaphene. The emulsion spray gave good mortality of larvae and adults of *Leptinotarsa decemlineata* (Say) on potato.

Bonetti (E. M.). **Prove comparative di lotta contro** *Leptinotarsa decemlineata.* [Comparative Tests on the Control of *L. decemlineata.*]—*Boll. Zool. agr. Bachic.* **19** fasc. 2 pp. 93–108, 2 graphs. Milan, 1953.

Calcium cyanamide is known to be toxic to *Leptinotarsa decemlineata* (Say) [*cf. R.A.E.*, A **33** 158; **34** 85], and an account is given of field-plot tests in Italy in 1952 in which it was compared with other insecticides for the control of the larvae and adults on potato. Treatments were applied on 15th–20th May, and the results assessed by expressing the numbers of dead larvae and adults on the treated plots a few days later as percentages of the numbers of living ones on the untreated plots and by comparing the final yields. Dusts of pure calcium cyanamide were applied at 13·5, 18 and 27 lb. per acre and oiled calcium cyanamide at 18 and 27 lb. The mortality percentages in three days, calculated in the manner described, and (in brackets) the yields in lb. per acre, were 76·9 (9,270), 73·9 (8,820) and 63 (7,830) for the pure material at the three rates, respectively, and scorching of the plants, which was slight, occurred only where the leaves had been fed on by the insects, so that the chemical came in contact with the sap. The oiled dust was more injurious, causing slight scorching of leaves and stalks at 27 lb. per acre and almost complete destruction of the crop at 18 lb., the latter treatment having been followed

by light rain. The percentage mortality of the insects was 68 in three days in the first case, with a yield of 6,273 lb. per acre, but was not calculated in the second. It is concluded that the pure dust is safer for use, since it adheres less to the foliage and is consequently less likely to cause scorching if rain follows treatment, and that the lowest of the rates was the best.

The other insecticides tested, all in sprays, were 0·2 per cent. parathion, 0·14 per cent. schradan, 2 per cent. DDT, 0·3 per cent. BHC, and 0·15 per cent. odourless BHC, all except parathion being proprietary preparations. The mortality percentages, calculated as above, and (in brackets) the yields in lb. per acre were 119·6 (11,970) for parathion, 93 (11,430) for schradan, 81 (10,530) for DDT, and 75 (10,170) and 89 (10,980) for the two BHC sprays, respectively. Normal BHC tainted the tubers. The yield from the untreated plots was 2,723 lb. per acre. The sprays were easier to apply than the calcium-cyanamide dusts and required less labour.

Petralia (L.). **Contributo sulle esperienze di lotta contro il verme rosa del cotone (Lepidottero Tortricide:** *Platyedra gossypiella*, **Saund.).** [A Contribution on Control Experiments against *P. gossypiella.*]—*Sicilia agric. for.* 1953 no. 5–6 repr. 16 pp., 9 figs., 1 graph, 9 refs. Palermo, 1953.

Cotton in Sicily is severely infested by *Platyedra gossypiella* (Saund.), up to 60 per cent. of the fibre being rendered unusable in some years. In experiments on control in 1951, sprays of 0·1, 0·3 and 0·5 per cent. parathion, 0·2–1 per cent. DDT and 0·2–1 per cent. BHC were applied on 6th–7th August, in time to afford protection to the bolls of the third and fourth pickings. DDT and BHC were ineffective, but parathion at the three concentrations reduced the percentages of injured bolls to 25, 18 and 19, respectively, at the third picking in mid-September, as compared with 56, 34 and 43 for no treatment. Heavy rain at the end of September destroyed the remainder of the crop.

In 1952, dry weather favoured the development of *P. gossypiella* and damage was more than usually severe. Sprays of 0·1, 0·3 and 0·5 per cent. parathion were applied on 20th July, 15th August, 10th September and 6th October, and the infestation percentages were about 66, 87·3 and 61·1 at the first picking, on 29th September, as compared with 69·5–75·6 for no treatment, about 91·7, 78·7 and 84·2 at the second picking, on 9th October, as compared with 86·8–87·3, about 80·2, 63·9 and 63·7 at the third, on 20th October, as compared with 90·6–91·6, and 54, 39·4 and 37·2 at the fourth, on 11th November, as compared with 69·7–71·4. The number of bolls infested was significantly lower on plots sprayed with 0·1 per cent. parathion than on untreated plots and significantly higher than on those sprayed with 0·3 and 0·5 per cent. parathion, which did not differ significantly between themselves. Infestation was highest at the second picking and lowest at the fourth, these differences being significant.

Experiments in controlling the Mediterranean Fruit Fly (*Ceratitis capitata* **Wied.) and the Olive Fly** (*Dacus oleae* **Gmel.).**—*Bull. Rehovot agric. Res. Sta.* no. 59, [44] pp., 8 refs. Rehovot, 1953. (In Hebrew pp. *1–22*, with abridged Translations in English, pp. 1–22.)

The abstracts that follow are based on the abridged translations of the four papers in this bulletin.

Avidov (Z.) & Swirski (E.). **Further Experiments in controlling the Mediterranean Fruit Fly** (*Ceratitis capitata* **Wied.) on Peaches,** pp. *3–8*, 3–8.

Ceratitis capitata (Wied.) is an important pest of peaches in the Judaean hills of Israel, and dieldrin, methoxy-DDT (methoxychlor) and DDT, all in wettable-powder sprays, were compared for its control at Kiryath-Anavim, near Jerusalem, in 1951–52.

In 1951, 0·05 per cent. dieldrin applied to an early variety on 20th May, 24 days before picking, gave no protection, and laboratory investigations showed that though both dieldrin and methoxy-DDT retained their effectiveness for longer than did an equal concentration of DDT, 0·05 per cent. dieldrin was insufficient for control. In a further test, sprays of 0·25 and 0·5 per cent. methoxy-DDT were applied to a late variety two or three times at weekly intervals from 15th July and afforded complete protection until picking, which lasted from 29th July to 8th August. The peaches on untreated trees, which had been covered at an early stage with paper bags to prevent infestation, were not injured until 24th July, after which infestation rose, reaching 79 per cent. by 8th August.

In 1952, the numbers of adults taken in traps containing 5 per cent. Clensel remained low until late June and increased rapidly in late July and August, when very large numbers were present. Sprays of DDT and methoxy-DDT, both at 0·5 per cent., were applied to a late variety three or four times at weekly intervals from 23rd June. Three applications permitted 0·5 and 2·5 per cent. infestation of fruits picked on 15th July, and four applications of either material afforded complete protection to those picked on 23rd July. The untreated control tree was entirely surrounded by the treated trees and showed no infestation on 15th July. Sprays of 0·5 per cent. methoxy-DDT, DDT and dieldrin were applied to another late variety on 15th July, and methoxy-DDT and DDT were applied a second time to some of the trees on 23rd July. Though attack had already begun by the first date, the percentages of infestation at picking, which lasted from 23rd July to 4th August, were less than 0·5 for one application of DDT or dieldrin, 0·6 for two applications of DDT, less than 2 for two applications of methoxy-DDT, and 4·6 for one application of methoxy-DDT, as compared with 78·3 for no treatment. Dieldrin, which should not be applied close to the date of picking because of its high toxicity, left an unsightly deposit on the fruits. It retained its effectiveness for 20 days, as compared with 10–11 days for DDT and methoxy-DDT, and it is concluded that one application of the former and two of either of the latter will afford control if made at the correct time.

In one of the tests, trees bearing unsprayed, bagged fruits were standing next to those sprayed with methoxy-DDT; infestation of the fruits by *Anarsia lineatella* Zell. reached 15 per cent. on the former but was only 2 per cent. on the latter.

Avidov (Z.) & Ben-Haim (N.). **Experiments in controlling the Mediterranean Fruit Fly (*Ceratitis capitata* Wied.) on Plums at Mikveh-Israel,** pp. *9–13*, 8–12. The results are given of experiments on the control of *C. capitata* on plums at Mikveh-Israel, near Tel-Aviv, in 1948–51. In 1948, two varieties were treated four and five times, respectively, at weekly intervals from 9th July, and the percentages of fruits infested at picking, a few days after the last application, were 5 and 2·7, respectively, for a spray of 0·2 per cent. DDT, 15·5 and 18 for one of 0·065 per cent. wettable γ BHC, 6·2 and 2·7 for a 10 per cent. DDT dust, and 9·8 and 14·4 for a dust containing 0·65 per cent. γ BHC, as compared with 14·8 and 11·2 for no treatment. On the second variety, an additional 3–6 per cent. of the fruits were infested by the codling moth [*Cydia pomonella* (L.)].

Infestation was negligible in 1949, and no experiments were carried out. In 1950, dusts of 5 per cent. methoxy-DDT (methoxychlor) or DDT were applied to three varieties at short intervals close to the ripening period. Two

applications on 11th and 15th June to the first of them reduced the percentage infestation to 1·2 and 2·7, respectively, at picking on 18th June, four to the second on 15th, 21st, 25th and 30th June reduced it to 1·4 and 1·8 on 2nd July, and three to the third on 7th, 11th and 14th July reduced it to 19·3 and 23·8 on 17th July. The corresponding figures were 1·1, 3·1 and 14 for a spray of 0·5 per cent. methoxy-DDT, and 10·9, 19·3 and 51·9 for no treatment.

In 1951, a medium variety of plum was treated on 24th June and 2nd and 8th July. The fruits were picked on 11th July, and the percentage infestation was 0·9 for a 5 per cent. DDT dust, 3·9 for a 0·25 per cent. DDT spray and 4·1 for a 0·25 per cent. methoxy-DDT spray, as compared with 7·2 for no treatment. A late variety was treated on 2nd, 8th and 15th July and picked while still unripe on 22nd July. The infestation percentages were 31·6, 3·4 and 5·9 for the same three treatments, respectively, as compared with 28·2 for none. An additional 2–5 per cent. of the fruits were infested by *C. pomonella*.

Avidov (Z.). **Preliminary Experiments in controlling the Mediterranean Fruit Fly (*Ceratitis capitata* Wied.) by Dieldrin,** pp. *13–15*, 12–15. In tests in 1951, a spray containing 0·05 per cent. wettable dieldrin was applied to apricots at Mikveh-Israel on 21st May, before infestation by *C. capitata* began. All the fruits were infested when picked on 18th June, but adults reared from them in the laboratory all died within 24 hours of emerging. When plums were sprayed on 24th June, the percentage of fruits infested at picking on 22nd July was 26·6, as compared with 28·2 for no treatment.

On 29th August, a spray of 0·5 per cent. dieldrin was applied to strawberry guava (*Psidium cattleianum*), in an acclimatisation garden. This tree produces numerous small, thin-skinned fruits of no commercial value that ripen over several months and are severely attacked by *C. capitata*. Only 1 per cent. of the fruits on the two treated trees was infested on 8th October, as compared with 59 per cent. on an untreated one.

Avidov (Z.), Harpaz (I.) & Mohrer (I.). **Experiments in controlling the Olive Fly (*Dacus oleae* Gmel.),** pp. *15–22*, 15–21. The authors review control measures tested against *Dacus oleae* (Gmel.) on olive in Israel in recent years [*cf. R.A.E.*, A **41** 383] and give an account of experiments on its control with sprays of wettable dieldrin and methoxy-DDT (methoxychlor) in 1952. Laboratory studies showed that these materials retained their effectiveness for 6–7 weeks in summer if applied at concentrations of at least 0·5 per cent.

At Huldah, near Tel-Aviv, trap-jars containing 5 per cent. diammonium phosphate were hung in the trees from May. Gravid females were present from the end of that month, and as large numbers were taken and eggs were laid in the second week of June, sprays were applied on 13th June. A second application was made on 17th July, when the numbers of females with mature eggs taken in the traps again increased. The olives were picked green in the second week of August, and the percentages of fruits infested were 1·4 and 4 for 0·5 per cent. dieldrin and methoxy-DDT, respectively, 6·2 for 0·2 per cent. methoxy-DDT with 1 per cent. molasses, and 22·4 for no treatment. More olives fell from the untreated than from the treated trees, and a higher percentage of them was infested.

At Mikveh-Israel, the increase in the numbers of gravid females occurred a week later than at Huldah, and sprays of 0·5 and 0·25 per cent. dieldrin were applied to trees of three varieties on 19th June and 21st July. The olives were examined weekly, and the percentages of fruits infested averaged 4 for 0·5 per cent. dieldrin, 16 for 0·25 per cent. dieldrin, and 16 for no treatment on 19th June, 14, 20 and 16, respectively, on 6th July, 20, 14 and 26 on 21st July, 4, 16·3 and 25 on 4th August, and 4·1, 27·1 and

37·5 on 18th August. At picking, on 28th August, there was little difference in infestation between treated and untreated trees for two of the varieties, one of which was picked while the olives were still green. On the third, dieldrin at 0·5 and 0·25 per cent. had reduced the percentage of fruits infested from 25·8 to 2·5 and 1·4, respectively. The sprays favoured *Planococcus* (*Pseudococcus*) *citri* (Risso), and the development of sooty mould on the honeydew of this mealybug increased with the dieldrin concentration, though there was none on untreated trees.

Sailer (R. I.). **Interspecific Hybridization among Insects with a Report on Crossbreeding Experiments with Stink Bugs.**—*J. econ. Ent.* **47** no. 3 pp. 377–383, 1 fig., 4 refs. Menasha, Wis., 1954.

The author briefly reviews literature on laboratory interspecific hybridisation in *Drosophila* and certain Lepidoptera, refers to its occurrence in mosquitos, and states that, like Foot & Strobell (1914), he obtained fertile hybrids from crosses between the Pentatomids, *Euschistus servus* (Say) and *E. variolarius* (P. de B.). The crosses were made in both directions, and the hybrids were reared for several generations. Fertility of the F_1 hybrid eggs was low, but the adults resulting were of great vigour, the females laying 4·6 times as many eggs as those of either of the parent species and the fertility of these eggs being very high and higher than that of the eggs resulting from back-crosses of F_1 adults to either of the parent species. Fertility of the eggs laid by F_2 hybrids was not so high. The effect of hybridisation on an internal male structure is illustrated.

It is inferred that, since hybrid populations of insects can be developed in the laboratory, they may also occur in nature and form an alternative to the concepts of species and subspecies. Some support for this view was obtained in a study of North American *Chlorochroa* populations. Hybridisation might also be envisaged as a means of breeding new and superior strains of parasites and predators.

King (J. C.). **The Genetics of Resistance to DDT in** *Drosophila melanogaster*.—*J. econ. Ent.* **47** no. 3 pp. 387–393, 3 graphs, 11 refs. Menasha, Wis., 1954.

The author describes experiments in which lines of *Drosophila melanogaster* Mg. were developed from a laboratory stock and from a batch of wild flies collected in New York in July 1952, by exposing the adults to a DDT aerosol for 4, 8, 16, 24 or 32 minutes and breeding from the survivors of treatments that gave over 95, over 90 and about 50 per cent. mortality. At the high level of selective intensity, every other generation was started by a single female survivor and the alternate generations were left untreated, at the intermediate level alternate generations were started by ten female survivors, and at the low level all survivors were used as parents in each generation. Comparison of median lethal exposure times showed no significant difference in resistance between the two unselected stocks, and the treated lines from the laboratory stock showed no measurable response to selection continued through 20 generations, whereas the lines developed from the wild stock at the low level of selective intensity showed a significant and the other treated lines an insignificant increase in resistance. Two crosses between lines gave intermediate resistance in the F_1 generation, and lower resistance and greater variance in the F_2 generation than in the F_1. All the evidence indicates that resistance is determined by a complex polygenic system of genetic factors.

Crow (J. F.). **Analysis of a DDT-resistant Strain of** *Drosophila*.—*J. econ. Ent.* **47** no. 3 pp. 393–398, 8 graphs, 2 refs. Menasha, Wis., 1954.

In an attempt to duplicate to some extent the conditions under which strains of insects develop resistance to DDT in nature, *Drosophila* was bred in cages in which DDT was applied to the inside surface in concentrations that were increased at irregular intervals over a period of three years. The initial population was a heterogeneous mixture of wild and laboratory stocks, to provide as wide a genetic base as possible for selection. Adult flies were tested for resistance after selection for six months and three years, by exposing them, and controls, for 6 or 24 hours to filter papers bearing deposits ranging from 0·6 to 5,120 μg. DDT per sq. cm. They showed an increase in resistance at both exposure periods, but whereas the median lethal deposit for the short exposure was six times as great after three years. that for the longer one was 2,000 times as great. By either criterion resistance increased about as much in the first six months of selection as in the remainder of the three years. Testing by topical treatment of individual flies with DDT in acetone showed median lethal doses of 0·018 and 0·073 μg. DDT for unselected and selected males and 0·03 and 0·127 μg. for unselected and selected females, the ratio of resistance (about 4:1) being comparable with that revealed by the shorter exposure to deposits. The difference in resistance shown at the two exposure periods did not appear to be due to different sets of genetic factors that come into effect in relation to different exposure periods and concentrations, since selection applied to a non-resistant strain by means of 3-hour and 24-hour exposures led to strains with indistinguishable resistance patterns.

Analysis of the development of resistance and tests of the F_1 and F_2 hybrids between the control flies and the resistant strain selected for three years suggested polygenic inheritance. No appreciable reversion to susceptibility took place after three years without further contact with DDT in the resistant strain selected for six months.

Glen (R.). **Factors that affect Insect Abundance.**—*J. econ. Ent.* **47** no. 3 pp. 398–405, 32 refs. Menasha, Wis., 1954.

Insect abundance is affected by numerous factors. The author depicts each natural community as a plastic but balanced system of variables and each insect population as one of the unstable components. The density of such a population at any given time is a product of the interactions of all concurrently active factors. Further study of the problems involved is urgently required, and three examples are cited from the literature to illustrate desirable trends in research. Two of these, both from Canada, are of economic interest and relate to the effect of climatic factors on the spruce budworm, *Choristoneura fumiferana* (Clem.) [*cf. R.A.E.*, A **39** 151], and the long-term effects of spray chemicals on insect populations in apple orchards [*cf.* **43** 71, etc.].

Watts (J. G.). **Response of Nut Grass to Soil Applications of organic Insecticides.**—*J. econ. Ent.* **47** no. 3 pp. 435–438, 7 refs. Menasha, Wis., 1954.

Nut grass (*Cyperus rotundus*) has recently increased in importance as a pest in experimental fields in South Carolina, particularly in cotton fields treated for insect control in several successive years. In tests of the effect of insecticides on it, plots received no treatment, or dusts of 3 per cent.

γ BHC (in technical BHC), 20 per cent. toxaphene, 5 per cent. DDT, 10 per cent. chlordane or 1 per cent. parathion, broadcast at 50, 250 or 500 lb. per acre a few days before planting, once a year in 1948–52 or in 1948 only, and the density of the nut grass was measured in 1952. Five annual applications of BHC at all rates, of toxaphene and DDT at the two highest and of chlordane at the highest caused an increase, whereas parathion caused none. No treatment had any significant effect when applied once only. There was little obvious difference in crab grass (*Digitaria* sp.) and none in other indigenous weeds. Treatment with 3 per cent. γ BHC at 50 lb. per acre is well within the rate used for the control of cotton pests. The mechanism involved in the increased nut-grass reproduction is not understood, but insect or nematode control appears unlikely as the cause. An ecological interaction may be involved. Nut grass propagates from rhizomes and exhibits apical dominance in its chainlike root-system of rhizomes, and it is possible that the insecticides upset the auxins that control this apical dominance.

Ahmed (M. K.), Newsom (L. D.), Emerson (R. B.) & Roussel (J. S.). **The Effect of Systox on some common Predators of the Cotton Aphid.**— *J. econ. Ent.* **47** no. 3 pp. 445–449, 6 refs. Menasha, Wis., 1954.

In the tests described, cultures of *Aphis gossypii* Glov. and insects predacious on it were established on cotton in the greenhouse, and Aphids that had been rendered moribund, without contact with the insecticide, by painting the upper surfaces of the detached leaves twice with a 1:900 solution of Systox (diethyl 2-(ethylmercapto)ethyl thiophosphate) were supplied twice a day for a week as food to the predators in petri dishes. The predators tested were the Syrphids, *Baccha clavata* (F.), *Metasyrphus wiedemanni* (Johnson) and *Allograpta obliqua* (Say), the Coccinellids, *Scymnus haemorrhous* Lec., *S. creperus* Muls., *Hippodamia convergens* (Guér.), *Ceratomegilla* (*Colcomegilla*) *maculata* (Deg.) and *Cycloneda sanguinea* (L.), and the Chrysopids, *Chrysopa rufilabris* Burm. and *C. oculata* Say; larvae of all these species and adults of the Coccinellids were used, and mortality counts were made daily.

The results showed that the Syrphid larvae were highly susceptible to Systox ingested in this way, with the exception of those of *A. obliqua* in the last instar, about 33 per cent. of which survived and gave rise to normal adults. Larvae of the Coccinellids suffered 100, 79·5, 51·6, 3·7 and 88 per cent. mortality, respectively; those of *S. haemorrhous* were susceptible in all instars, but last-instar larvae of the other species survived. Most Coccinellid adults showed almost complete resistance, but those of *Cycloneda sanguinea* suffered 56 per cent. mortality. The Chrysopid larvae were little affected.

In some of the tests, Systox prepared from radioactive sulphur (S^{35}) was used, and the predators were dried, ground and assessed for radioactivity. Last-instar larvae of *A. obliqua* and *M. wiedemanni* that were killed by feeding on the poisoned Aphids showed radioactivity of 1·89 and 0·85 counts per minute per mg., respectively. Larvae of *H. convergens* that survived showed much less radioactivity than those that succumbed in the same feeding period. The radioactive material apparently accumulated in the bodies of the larvae, since third- and fifth-instar individuals that survived treatment showed 4·26 and 7·29 counts per minute per mg., as compared with 22·8 and 15·32 for those that were killed, respectively. Adults of *H. convergens* showed much less radioactivity than larvae when both fed on radioactive Aphids, and adults that developed from such larvae showed less

than the prepupae; the cast pupal skin showed much more than either. Larvae of *Chrysopa oculata* that fed for eight days showed 1·54 counts per minute per mg., but survived.

MORISHITA (F. S.). **Biology and Control of** *Brevipalpus inornatus* **(Banks).** —*J. econ. Ent.* **47** no. 3 pp. 449–456, 4 figs., 15 refs. Menasha, Wis., 1954.

The author gives lists showing the numerous food-plants and the world distribution of *Brevipalpus inornatus* (Banks), of which *Tenuipalpus bioculatus* McG. [*cf. R.A.E.*, A **32** 265] and *T. pseudocuneatus* Blanch. [*cf.* **34** 298] have been shown to be synonyms, describes all stages of this mite, and states that it has recently been observed causing severe damage to *Anthurium* and orchids in nurseries on Oahu (Hawaiian Islands) and in southern California.

Observations in California showed that the mite overwinters chiefly in the adult stage, in sheltered sites on the plants, though all stages are present throughout the winter in glasshouses. It was reared through numerous generations in the laboratory, and experiments on its control on ornamental plants were made. The following is based on the author's summary of the results. Parthenogenetic females gave rise to females only, and males were rare. The preoviposition and incubation periods ranged from 1·5 days at 27°C. [80·6°F.] to 8 days at 20°C. [68°F.] and from 5 days at 32°C. [89·6°F.] to 17 at 20°, respectively, the larval, protonymphal and deutonymphal stages from averages of 3·5, 4·1, and 2·7 days, respectively, at 30°C. [86°F.] to 9·5, 7·9 and 9·2 days at 20°, and development from hatching to the adult stage from 7 days at 30° to 33 days at 20°C. The maximum length of life of an adult female was 75 days at 20°C., and the maximum number of eggs 60 at 27°C.

In the control experiments, single spray applications were made and the numbers of living mites per leaf counted 1, 2 and 3 weeks later. In emulsion concentrates diluted 1:800, 25 per cent. Chlorobenzilate (ethyl 4,4′-dichlorobenzilate) [also known as 2-hydroxy-2,2-bis(p-chlorophenyl) ethyl acetate] and DMC [1,1-bis(p-chlorophenyl)ethanol] gave complete mortality throughout the period, and 25 per cent. Ovotran (p-chlorophenyl p-chlorobenzenesulphonate) and Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] were more effective than 60 per cent. toxaphene, 50 per cent. malathion or 15 per cent. rotenone. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-pyrimidinyl(6) thiophosphate] at 2 lb. 25 per cent. wettable powder per 100 U.S. gals. also gave complete mortality and is the only organic phosphate that has proved very effective for the control of *B. inornatus*.

ASQUITH (D.). **The Periodical Cicada in southern Pennsylvania in 1953.**— *J. econ. Ent.* **47** no. 3 pp. 457–459, 5 refs. Menasha, Wis., 1954.

The following is based largely on the author's summary. Brood X of *Magicicada septendecim* (L.) emerged in May 1953 in southern Pennsylvania. Observations in orchards in which apple trees had been cut down, but the sod cover left, showed that no adults emerged from those in which the trees were cut down in 1948 or 1949, increasing numbers from those cut in 1950 and 1951, and as many in sites cleared in 1952 as in standing orchards, indicating that the nymphs feed on the tree roots and cannot survive when only grass roots are available [*cf. R.A.E.*, A **43** 41].

Oviposition occurred in June, and apple, peach and pear trees were more severely injured by the egg-slits than were other fruit trees. Apple trees 1–3 years old were easily protected by covering with net, but those 4–10 years old required repeated sprays of TEPP [tetraethyl pyrophosphate] if on sites subject to reinfestation from outside. In apple orchards in bearing, the adults were controlled by spraying with 6 fl. oz. 40 per cent. TEPP per 100 U.S. gals. in dilute sprays and 1 pint per 100 gals. in more concentrated sprays, the number of applications depending on the frequency of reinfestation. Some orchards near woodland were protected by spraying the edges of both from an aeroplane with 1 U.S. pint 40 per cent. TEPP in 4 U.S. gals. water or oil carrier per acre. Sprays of parathion, malathion, DDD (TDE) and CS-708 [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] and TEPP dusts were relatively ineffective. Methoxy-DDT (methoxychlor) gave higher kills, but was slow in action; in one test, 4 oz. 21·2 per cent. demeton [diethyl 2-(ethylmercapto) ethyl thiophosphate] per 100 U.S. gals. gave 65 per cent. kill in 24 hours, indicating that higher concentrations should be tested.

Newcomer (E. J.). **Identity of** *Tetranychus pacificus* **and** *mcdanieli*.—*J. econ. Ent.* **47** no. 3 pp. 460–462, 2 refs. Menasha, Wis., 1954.

In 1937, a Tetranychid mite that caused injury in apple orchards in the Pacific Northwest of the United States and had been present for several years was assumed to be *Tetranychus bimaculatus* Harvey. In 1938, *T. pacificus* McG. was found to be the only mite on apple in Washington, and the predominant species in the Yakima Valley was identified as *T. pacificus* or *T. bimaculatus* in 1950 and as *T. mcdanieli* McG. in 1951. This change in identification suggested that *T. pacificus* and *T. mcdanieli* might not be distinct species, and reciprocal cross-breeding experiments were carried out in 1953 with authentic *T. pacificus* from California and *T. mcdanieli* from the Yakima Valley. Since unfertilised eggs of these mites give rise to males only, the production of 97–99 per cent. males in the tests indicated that fertilisation had not occurred and that the species are distinct, the few females produced probably resulting from pairing mites mistakenly identified as not of the same species. No reason is known for the rapid replacement of *T. pacificus* by *T. mcdanieli*.

Osmun (J. V.). **Protection of stored shelled Corn with a Protectant Dust in Indiana.**—*J. econ. Ent.* **47** no. 3 pp. 462–465, 5 refs. Menasha, Wis., 1954.

In the test described, the dust used was Pyrenone Protectant T-483, consisting of 1·1 per cent. piperonyl butoxide and 0·08 per cent. pyrethrins inpregnated directly on a carrier of maize-cob flour. Two 3,000-bushel bins of shelled maize in Indiana were turned and fumigated, but otherwise not treated, and two were fumigated, cleaned and treated with 75 lb. dust per 1,000 bushels, introduced into the grain stream during turning. In addition, 15 lb. dust was applied to the floor of each cleaned test bin, with particular attention to the seams and rims, and an additional 8 lb. to the top five inches of maize in each. The treatment was carried out on 20th September 1951, and examination of maize samples taken at intervals until 26th October 1953 showed a highly significant difference between treated and untreated bins, the numbers of living insects found being 211 out of a total of 347 in the treated and 1,447 out of 1,805 in the untreated bins. The most important insects, in order of decreasing numbers, were *Oryzaephilus*

surinamensis (L.), *Laemophlocus minutus* (Ol.) (*pusillus* (Schönh.)), *Tribolium castaneum* (Hbst.), *Plodia interpunctella* (Hb.) and *Ahasverus advena* (Waltl); those present in small numbers comprised *Cynaeus angustus* (Lec.), *Typhaea stercorea* (L.), *Alphitobius diaperinus* (Panz.), *Tribolium confusum* Duv., *Tenebrio molitor* L. and *Calandra* (*Sitophilus*) *granaria* (L.). *L. minutus* occurred most frequently in both treated and untreated bins, whereas *O. surinamensis* contributed greatly to the larger numbers in the untreated bins towards the end of the test period but was rare in treated ones. *P. interpunctella* was particularly abundant on the surface of untreated maize from eight months after fumigation, but did not appear in treated bins for 14 months and was then rare. Seasonal differences for all insects were highly significant. In treated bins, insects were most numerous near the surface and the maize below remained free of heavy infestation throughout the test period, whereas in untreated bins there was no significant difference between levels. The moisture content of the maize was 11·4–19·7 per cent. throughout the test period, with no significant difference between bins.

Ginsburg (J. M.) & Reed (J. P.). **A Survey on DDT-Accumulation in Soils in Relation to different Crops.**—*J. econ. Ent.* **47** no. 3 pp. 467–474, 25 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. Investigations were made in 1953 to determine the quantities of DDT that had accumulated in New Jersey soils as a result of spray and dust applications to different crops, soil samples taken to a depth of 12 ins. being analysed from apple orchards, maize fields, potato farms and a cranberry bog, all of which had been sprayed or dusted for insect control for the previous six years. In the orchards, there was 35–113 lb. DDT per acre beneath the trees and 26–61 lb. per acre between them, most being found in the upper four inches of soil, corresponding to the average depth of cultivation, with small amounts at 4–8 ins. and very little at 8–12 ins. The cranberry bog contained 34·5 lb. DDT per acre, of which 32 lb. was in the top four inches of soil, the maize fields 5·8–19 lb. per acre, with an average of 11 lb., and the potato fields about 4–15 lb. per acre, with an average of 7 lb. Practically all the DDT recovered from the potato and maize fields was in the top nine inches, corresponding to the average plough depth, and it appears that DDT residues do not penetrate below the depth of cultivation. The type of soil had no significant effect on the amount of DDT retained.

Davis (A. C.), Swenson (K. G.) & Patterson (M. E.). **Cabbage Maggot Control in late Cabbage.**—*J. econ. Ent.* **47** no. 3 pp. 475–479, 4 refs. Menasha, Wis., 1954.

In western New York, lack of an economical and effective method of controlling the cabbage maggot [*Hylemyia brassicae* (Bch.)] has been one of the main factors limiting the sowing of late cabbage directly in the field in which it is to mature, and in 1950, four insecticides were tested for field control. They were diluted with pyrophyllite, broadcast at 500 lb. dilute dust per acre and harrowed into the top 3–4 inches of soil two days before the cabbage seed was sown. Aldrin, dieldrin and heptachlor were effective at dosages of 8, 4 and 6 lb. toxicant per acre, respectively, but chlordane gave relatively poor results at 8 lb. There appeared to be no correlation between number of roots injured and cabbage yield. In tests of the persistence of such treatments in the following year, dieldrin and aldrin at 8 lb. per acre

significantly reduced the amount of damage to subsequent crops of both cabbage and swedes.

In 1951, the protection afforded by dieldrin was not reduced by application at 4 lb. in 20 U.S. gals. emulsion spray per acre or at 0·6 lb. per acre in a 1 per cent. dust in the seed furrow, and the low rate of application in the last would tend to make it a preferred method. In 1952, emulsion sprays applied in the seed furrow at the time of sowing were not entirely satisfactory, but dieldrin at 1 lb. per acre showed more promise than aldrin or heptachlor at 1 lb. or chlordane at 2 lb.

In 1953, the same insecticides were tested for the control of *H. brassicae* on radish in the seedbed. When measured amounts of wettable powder were sprayed over the soil surface and raked into the top 3–4 inches before sowing, dieldrin at 2–6 lb. per acre, aldrin at 4–8 lb. and heptachlor at 2–4 lb. gave satisfactory protection, whereas chlordane at 4–8 lb. did not.

Dean (R. W.). **Further Studies of Insecticides for Apple Maggot Control.** —*J. econ. Ent.* **47** no. 3 pp. 479–485, 1 graph, 2 refs. Menasha, Wis., 1954.

Further investigations were made in New York in 1951–53 on the control of *Rhagoletis pomonella* (Walsh) [*cf. R.A.E.*, A **39** 305, etc.]. Sprays were prepared from wettable powders unless otherwise indicated, and insecticide quantities are given per 100 U.S. gals. In laboratory tests in which adults were exposed for 24 hours in petri dishes to films obtained from sprays, 1 lb. 15 per cent. parathion, 2 lb. 50 per cent. DDT and 4 lb. 25 per cent. heptachlor or dieldrin caused at least 90 per cent. mortality for 3, 7, 8 and 18 days, respectively. Mortalities from a standard spray of 3 lb. lead arsenate did not exceed 20 per cent. When the sprays were applied to a food film on one surface of a test cage in which the flies were confined, 0·5 and 4 lb. 50 per cent. Compound 1189 (2,3,3a,4,5,6,7,7a,8,8-decachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene-1-one) caused complete mortality within five days and in at least three, respectively, those from 0·5, 1 and 2 lb. 50 per cent. Strobane (a chlorinated mixture of -pinene isomers containing about 66 per cent. chlorine) in 9, 2 and 1 days, respectively, and those from 1 and 0·5 lb. 25 per cent. Diazinon (O,O-diethyl O-2-isopropyl-4-methyl-pyrimidinyl(6) thiophosphate) in 1 and 5 days, respectively. Lower concentrations of Diazinon did not give complete kill even in ten days. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] at 1·5 lb. 15 per cent. material killed 70 per cent. of the flies in five days, which was unexpected. When the entire inner surface of the cage was sprayed and the flies were exposed to residues from 2 lb. 50 per cent. Compound 1189 or Strobane or 4 lb. 25 per cent. Diazinon for 5–60 minutes and examined for mortality after 1, 5 and 10 days, Compound 1189 exhibited the slowest toxic action and Diazinon the most rapid.

In orchard tests on apple, Q-137 [ethyl-DDD (1,1-di(p-ethylphenyl)-2,2-dichloroethane)] reduced heavy infestations to low levels when applied at 1 lb. actual toxicant in wettable-powder sprays 4–6 times during the season, according to fly emergence, but was less effective when used six times at the same rate in an emulsion spray or eight times as a 5 per cent. dust. Five applications of 2 lb. 50 per cent. p,p′methoxy-DDT (methoxychlor) gave only fair control in one test in which the sprayed trees were subject to infestation from untreated ones, but proved very effective under less adverse conditions. Six applications of 4 lb. 25 per cent. wettable CS-708 [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] gave good control, but a commercial mixture (Blackleaf 253)

containing 25 per cent. DDT and 3 per cent. parathion, used at 2·5 lb., did not, and sprays of 2 lb. 25 per cent. malathion or 50 per cent. Compound 1189 and of 0·5 lb. 50 per cent. dieldrin were not effective enough to be of practical value.

Scharff (D. K.). **The Role of Food Plants and Weather in the Ecology of *Melanoplus mexicanus mexicanus* (Sauss.).**—*J. econ. Ent.* **47** no. 3 pp. 485–489, 20 refs. Menasha, Wis., 1954.

Melanoplus mexicanus mexicanus (Sauss.) is one of the most widely distributed and destructive grasshoppers in the United States, and no satisfactory method of predicting outbreaks or of controlling them in the incipient stage has been developed, partly because it has been believed that grasshoppers thrive on almost any plants and that populations are high during or after dry weather and low in wet weather. Both these impressions are probably incorrect, and the author gives evidence from his own and other work to show that some plants are much more favourable than others to *M. mexicanus* and are generally preferred; lucerne is an exception, in that it is preferred but apparently not conducive to optimum growth and reproduction. The plants that have been reported as favouring the grasshopper are small-grain crops and quick-growing, succulent, aggressive weeds, most of them annuals, that are capable of abundant and widespread growth in a favourable environment. Ordinary tillage reduces the importance of fields of small grain as primary sources of *Melanoplus*, since the eggs do not survive, but they are subject to invasion from other sources and may maintain high populations for some time after. The annual weeds seem to be the major source of outbreaks, occurring in such places as abandoned fields and range land in poor condition. Populations of the grasshopper are known to fluctuate in a manner similar to that described for certain of its food-plants, and if it depends for its optimum needs on a limited number of food-plants in any particular area, this, together with consideration of weather, will provide a sounder basis on which to predict changes in its numbers.

Swenson (K. G.), Davis (A. C.) & Schroeder (W. T.). **Reduction of Pea Virus Spread by Insecticide Applications.**—*J. econ. Ent.* **47** no. 3 pp. 490–493, 7 refs. Menasha, Wis., 1954.

Virus diseases cause considerable loss of peas in New York. Their principal and possibly only important vector is *Macrosiphum pisum* Harris (*pisi* (Kalt.)). Lucerne and clover are the winter hosts both of the viruses and of this Aphid, and the viruses are transmitted to peas by the latter at the time of spring migration and spread by it within the crop. Tests of demeton (diethyl 2-(ethylmercapto)ethyl thiophosphate), applied to soil, seed or foliage in 1951, indicated that it reduced the spread of the viruses to some extent by controlling the Aphid, and further investigations with it and with parathion, both in emulsifiable concentrates, were carried out in 1952 and 1953.

In 1952, the application of demeton at 0·66 oz. actual compound per bushel to the seed and at 0·5 lb. per acre in a spray to the soil on the day of sowing reduced the percentage of plants infected with viruses (of which pea enation mosaic was the only one identified) from 53 to 40 and 31, respectively, and foliage sprays of 0·5 lb. demeton per acre on 16th and

25th June and 8th July or on 25th June only and of 0·25 lb. parathion per acre on the same three dates or on 16th June and 8th July, both in 23 U.S. gals. water, reduced it to 20, 30, 24 and 35, respectively. In 1953, three applications of 1 U.S. pint 25 per cent. parathion emulsion concentrate in 19 U.S. gals. water per acre reduced the relatively low virus incidence from 13·5, 29 and 21·9 per cent. to 3·2, 8·4 and 10·4 per cent., respectively, in three large plantings that were harvested by commercial processes.

Yield records indicated that a reduction of as little as 11·5 per cent. in virus infection was in some cases more than enough to pay for the cost of the parathion treatment and that a reduction of 20 per cent. caused a definite increase in the value of the crop.

Tozloski (A. H.). **Control of Onion Maggot on Seed Sets in the Connecticut Valley.**—*J. econ. Ent.* **47** no. 3 pp. 494–497, 12 refs. Menasha, Wis., 1954.

In the Connecticut Valley, onions are grown from seed in dense stands to provide sets for planting out in the following year, and are sometimes seriously injured by *Hylemyia antiqua* (Mg.). In investigations on control of the fly at Sunderland, Massachusetts, in 1952 and 1953, sprays applied to the stands of young plants four times at approximately ten-day intervals from 12th May, when the first adults were found, were expensive and gave only 65 per cent. reduction in damage when dieldrin was used at 0·5 lb. per acre and less for DDT, chlordane, heptachlor, aldrin and parathion used at 0·6, 2, 0·75, 0·75 and 0·25 lb. per acre, respectively. Coating the seed by mixing it with an insecticide in the presence of an adhesive, so as to form pellets, and allowing it to dry before sowing, gave 96·8 per cent. reduction when 10 per cent. DDT or 1 per cent. dieldrin dusts were mixed with twice their weight of seed, but only 15·9 and 58 per cent. when 1 per cent. heptachlor or 5 per cent. DDT was used in the same way. Mixing the seed thoroughly with the dry insecticide dust alone proved to be the simplest and most effective treatment, 1 per cent. dieldrin and 10 per cent. DDT giving 97·5 and 98·6 per cent. reduction in damage when used at 0·5 lb. per lb. seed and 95·5 and 95·1 per cent. when used at 0·25 lb. per lb. Calomel [mercurous chloride], 1 per cent. aldrin or heptachlor, and 5 per cent. chlordane or DDT were less effective.

Schread (J. C.). **Control of Insect Pests of Ornamentals.**—*J. econ. Ent.* **47** no. 3 pp. 498–500, 2 refs. Menasha, Wis., 1954.

In tests on the control of insects attacking ornamental plants in Connecticut, sprays prepared from emulsion concentrates containing 57 per cent. malathion or 30·6 per cent. Potasan (diethyl 4-methyl-7-coumarinyl thionophosphate) diluted to 1:400 and 1:800 gave complete mortality of *Lepidosaphes ulmi* (L.) when applied on 6th June to *Cladrastis lutea* and lilac (*Syringa vulgaris*), on which 95 and 40–50 per cent. of the eggs, respectively, had hatched.

Treatment of young, heavily infested *Pinus mugo* (*montana*) with the malathion concentrate or one containing 25 per cent. parathion at dilutions of 1:200, 1:400 or 1:800 on 27th May gave almost complete control of *Phenacaspis pinifoliae* (Fitch), though a few scales that hatched after treatment, particularly that with parathion, survived. These gave rise to a fairly heavy population on plants treated with parathion at the two lowest

concentrations, whereas those treated with malathion were virtually free from infestation. Against *Eriococcus azaleae* Comst. on azalea, one application of the Potasan or malathion concentrate at 1:400 or 1:800 on 6th August, after the eggs had hatched, gave complete control in 1953, whereas 20 per cent. TEPP [tetraethyl pyrophosphate], 40 per cent. nicotine sulphate or 40 per cent. Loro (technical lauryl thiocyanate) at the same dilutions applied on 25th June 1951, before hatching was complete, had to be followed by second applications on 9th July for complete mortality. Two applications of 25 per cent. lindane [almost pure γ BHC], 48 per cent. chlordane, 21·85 per cent. aldrin or 15 per cent. dieldrin in emulsion concentrates at the same dilutions gave poor control of the young scales.

One application of the malathion concentrate at 1:200–1:1,600 on 20th May gave complete control of *Fenusa pusilla* (Lep.) on grey birch (*Betula populifolia*), and one on 15th July gave complete control of *Monarthropalpus buxi* (Lab.) on box [*Buxus*] at 1:400 but not at greater dilutions.

Treatment of hawthorn (*Crataegus oxyacantha*) with an emulsion concentrate containing 25 per cent. Isolan (1-isopropyl-3-methyl-pyrazolyl(5) dimethylcarbamate) at 1:400–1:1,600 on 9th July kept populations of *Aphis pomi* Deg. and *Amphorophora crataegi* (Monell) low throughout the summer, whereas the malathion concentrate or one containing 13·75 per cent. γ BHC on the same date gave good immediate control but had to be repeated on 21st August to prevent an increase to injurious numbers before the end of the season.

Roan (C. C.) & Maeda (S.). **The Cholinesterase Systems of three Species of Fruit Flies and the Effects of certain insecticidal Compounds on these Enzymes.**—*J. econ. Ent.* **47** no. 3 pp. 507–514, 3 graphs, 9 refs. Menasha, Wis., 1954.

The authors' investigations on the brain cholinesterase of *Dacus dorsalis* Hend. and its inhibition by phosphorus insecticides and by Pyrolan (1-phenyl-3-methyl-pyrazolyl(5) dimethylcarbamate) [*cf. R.A.E.*, A **42** 152] were extended to two other fruit-flies, *D. cucurbitae* Coq. and *Ceratitis capitata* (Wied.), and carbamates structurally related to Pyrolan. The substrates used were acetyl choline and acetyl-β-methyl choline, and the effects of the concentrations of these on their rate of hydrolysis by the brain cholinesterases of the insects were investigated by varying the amount of enzyme instead of the amount of substrate, in order to overcome limitations in the colorimetric procedures adopted. The results indicated that the cholinesterase in all three species is specific for acetyl choline. The curves for the hydrolysis of the substrates showed similar maxima, and the data for the theoretical maximum velocities and dissociation constants were of the same order for all three insects.

The concentrations of eight phosphorus compounds and 14 carbamates, including Pyrolan, required for 50 per cent. inhibition of the cholinesterase of the three insects were determined *in vitro* and showed only minor differences between species. All the carbamates tested proved to be inhibitors, and activity was in general decreased by removal of the phenyl group on position 1 of the pyrazolyl ring in the Pyrolan molecule to give 3-methyl-pyrazolyl(5) dimethylcarbamate. Changes in the group on position 3 of the ring had little effect, but the substitution of a triazolyl ring for the pyrazolyl ring reduced activity.

The toxicity of paraoxon, Pyrolan and five other carbamates to the insects was investigated by topical application of acetone solutions. The results showed considerable variation in effectiveness, Pyrolan and 3-methyl-pyrazolyl(5) dimethylcarbamate being about equally toxic and only slightly less

so than paraoxon to all three species, and the others varying widely with species and compound. These differences indicate that factors other than cholinesterase inhibition may be involved in toxicity and that the three species differ biochemically.

Rodriguez (J. G.). **Radiophosphorus in Metabolism Studies in the Two-spotted Spider Mite.**—*J. econ. Ent.* **47** no. 3 pp. 514–517, 2 graphs, 8 refs. Menasha, Wis., 1954.

The following is based on the author's introduction and summary. The numbers of *Tetranychus bimaculatus* Harvey that develop on tomato leaves have been shown to be positively correlated with the phosphorus content of the latter up to about 0·3 per cent. dry weight of foliage. Since this content of phosphorus is common in the food-plants of the mite, phosphorus metabolism was studied by allowing young adult females to feed on leaves of bean plants grown in a solution incorporating radioactive phosphorus (P^{32}) and determining the radioactivity of the mites and eggs at intervals for ten days. Almost half the acquired radioactive phosphorus was taken up during the first eight hours of feeding. Full capacity (2,007 counts per minute) was reached in about 36 hours, but uptake continued slowly thereafter as the mites grew in size. The amount of radioactive phosphorus in the egg was an approximately constant proportion of that in the adult mite (maximum 107 counts per minute). Utilisation of phosphorus in egg production proceeded at a rate similar to uptake, but utilisation in the body of the mite was much slower, since about 20 hours were required for half the radioactive phosphorus to be used. This change of rate is probably due to growth as the mite ages. Phosphorus was three times as concentrated in the egg as in the mite body. The females lived for an average of 10·85 days and laid an average of 10·3 eggs per day during this time, and egg production therefore consumes relatively large quantities of phosphorus. When radioactive mites were transferred to non-radioactive leaf disks, these became radioactive, showing that a secretion containing phosphorus, thought to originate in the tracheal salivary gland, was injected into the leaf.

Hutchinson (M. T.). **Control of the Cranberry Fruitworm on Blueberries.**—*J. econ. Ent.* **47** no. 3 pp. 518–520, 7 refs. Menasha, Wis., 1954.

Various organic insecticides were tested for the control of *Mineola vaccinii* (Riley) in a heavily infested field of blueberries in New Jersey in 1953, four spray applications being made at intervals of 4–6 days from 27th May, when the first eggs had just hatched. All spray quantities are given per 100 U.S. gals. At the first picking, on 26th June, the numbers of larvae and (in brackets) the numbers of clusters of webbed fruit per 800–1,000 berries were 59 (166) for no treatment, 5 (9) and 5 (12) for treatment with 2 lb. 50 per cent. DDT and DDD (TDE), respectively, 1 (2) for 2 lb. 25 per cent. malathion, 1 (7) and 4 (32) for 1·5 lb. 15 per cent. parathion or 27 per cent. EPN [ethyl p-nitrophenyl thionobenzenephosphonate], 1 (3) for 3 lb. 50 per cent. p,p'methoxy-DDT (methoxychlor) and 0 (7) for 1 U.S. pint 19 per cent. endrin. Q-137 [ethyl-DDD (1,1-di(p-ethylphenyl)-2,2-dichloroethane)], lindane [γ BHC] and ryania were less effective. Endrin was in an emulsion concentrate, and the other materials in wettable powders.

Although rain was unusually heavy, there were considerable accumulations of residues on the berries at the first picking, and not more than two applications should be made in practice. There was a slight fall in residues

at the second picking, a week later, probably owing to berry growth. Fruit treated with methoxy-DDT had an inferior flavour.

Jeppson (L. R.), Jesser (M. J.) & Complin (J. O.). **Seasonal Weather Influence on Efficiency of Systox Applications for Control of Mites on Lemons in southern California.**—*J. econ. Ent.* **47** no. 3 pp. 520–525, 2 figs., 5 refs. Menasha, Wis., 1954.

Systemic insecticides have shown promise for the control of mites on *Citrus* in California [*cf. R.A.E.*, A **41** 81] but their effectiveness varies at different times of the year. In studies on this variation, applications of Systox at the rate of 0·5 or 1·5 oz. active ingredient [diethyl 2-(ethylmercapto)ethyl thiophosphate (demeton)] per tree, in a foliage spray or trunk paint, were made to lemon trees each month from May to December 1952 and in March and April 1953, and the effect determined by picking fruits two weeks after treatment, infesting them with adults of *Paratetranychus* (*Metatetranychus*) *citri* (McG.) in the laboratory and determining the percentage mortality after 96 hours, and also by examining buds on five terminals per tree for the presence of *Aceria sheldoni* (Ewing). Applications were also made to the soil below trees each month from May to September 1952.

The results indicated that seasonal weather changes influence the absorption, translocation and persistence of spray, trunk and soil applications of Systox, varying with the method of application. Soil application was less effective than sprays or trunk treatment and was discontinued in September. Spring and summer conditions appeared to be most favourable for absorption of the toxicant by the roots and translocation to other parts of the tree, but under the most favourable conditions it gave not more than 81 per cent. mortality of *P. citri* and an ineffective reduction of *A. sheldoni*. Spray treatments appeared to be least effective in July–October, but gave a high initial mortality of *P. citri* at all times. Treatment at 0·5 oz. per tree gave less than complete initial mortality at this time but complete initial mortality during November–June, and although 1·5 oz. gave complete kills, the effect was less persistent in summer than in winter, probably owing to evaporation during application and from surface residues. When the toxicant was applied to the trunks, 7–20 days were required for absorption and translocation to the fruits in amounts sufficient to give high mortality of *P. citri*. Trunk applications gave relatively poor kills of *P. citri* in November and December as compared with March–October, and temperature did not appear to be the critical factor. Summer applications were more persistent in toxicity than sprays, probably because of greater evaporation and loss of surface residue from the latter. Summer sprays caused only slight reductions in *A. sheldoni*, and autumn and winter treatments had no apparent effect. Summer trunk applications were rather more effective against this mite than summer sprays.

Taylor (E. A.). **Parasitization of the Salt-marsh Caterpillar in Arizona.**—*J. econ. Ent.* **47** no. 3 pp. 525–530, 9 refs. Menasha, Wis., 1954.

Large bands of larvae of *Estigmene acraea* (Dru.) occasionally destroy autumn-grown vegetables in the Salt River Valley of Arizona. One of the main sources of the migrating larvae is cotton, and as late-season feeding on this is not harmful, chemical control is seldom practised. The larvae have been more numerous since 1945, and investigations were carried out in 1950–51 to see whether this was due to an effect of modern insecticides,

applied against other pests, on their parasites. Collections in cotton fields showed that *Tachina* (*Exorista*) *larvarum* (L.) and *Leschenaultia* (*Rileymyia*) *adusta* (Lw.) parasitised a high percentage of the fifth-instar larvae, and laboratory tests indicated that adults of both these Tachinids were readily killed by dust deposits of insecticides commonly applied to cotton in Arizona. In limited experiments, DDT killed the parasites within larvae that fed on sprayed leaves, while permitting the host larvae to complete their development normally, and this suggests that the recent widespread use of DDT on cotton has reduced the parasite population without having much direct effect on the pest.

Sherman (M.), Tamashiro (M.) & Fukunaga (E. T.). **Control of Greenhouse Whitefly and other Insects on Beans in Hawaii.**—*J. econ. Ent.* **47** no. 3 pp. 530–535. Menasha, Wis., 1954.

The following is based on the authors' introduction and summary. *Trialeurodes vaporariorum* (Westw.), *Empoasca solana* DeLong and *Maruca testulalis* (Geyer) are among the most injurious insect pests of green beans in Hawaii, and several tests of organic insecticides for their control were carried out in 1952–53. In three small-plot experiments in which sprays were applied to a pole variety three times at weekly intervals against *Trialeurodes*, 0·032 per cent. parathion and 0·063 per cent. EPN [ethyl p-nitrophenyl thionobenzenephosphonate] gave excellent control, and 0·016 per cent. parathion, 0·25 per cent. DDT, p,p′methoxy-DDT (methoxychlor) or chlordane, 0·125 per cent. toxaphene or dieldrin, and 0·063 per cent. aldrin gave good control. In a fourth experiment, in which 0·016 per cent. parathion, 0·032–0·128 per cent. malathion, 0·064–0·128 per cent. CS-708 [a 1:2 mixture of 1,1-bis-(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane] and 0·068–0·135 per cent. EPN were applied three times at intervals of one or two weeks, parathion, malathion and CS-708 were more effective when applied weekly, whereas EPN was equally effective in both schedules. All the materials tested gave good control of *E. solana* and *M. testulalis*.

Dahms (R. G.) & Sieglinger (J. B.). **Reaction of Sorghum Varieties to the Chinch Bug.**—*J. econ. Ent.* **47** no. 3 pp. 536–537, 1 ref. Menasha, Wis., 1954.

The results are given of investigations in two years and at two places in Oklahoma, in which more than 30 varieties of sorghums were tested for resistance to *Blissus leucopterus* (Say). Some of them showed consistent resistance, as measured by the percentage of plants killed by the bug.

Wolfenbarger (D. O.). **A Comparison of dilute and concentrate Sprays for Control of Insects of Potato and Tomato.**—*J. econ. Ent.* **47** no. 3 pp. 537–539. Menasha, Wis., 1954.

Experiments were carried out on potato and tomato in Florida in 1951–53, in which 1 lb. 15 per cent. parathion or 0·33 U.S. pint concentrate containing 4 lb. parathion per U.S. gal. was combined with fungicides in 100 U.S. gals. spray applied at 75–175 U.S. gals. per acre by means of machines equipped with booms and 3–11 nozzles per row, or in 20 U.S. gals. spray applied at about one fifth of these rates with a similar machine having 3–4 nozzles per row or with a mist-blower. Mines made by larvae of the complex of *Liriomyza pusilla* (Mg.) were common on both plants; Aphids, mainly

Myzus persicae (Sulz.) with small numbers of *Aphis gossypii* Glov., were present on potato, and fruit injury attributed mostly to *Heliothis armigera* (Hb.), though *Laphygma frugiperda* (S. & A.) was also present, was found on tomato.

On potato in 1951–52, the dilute spray and the concentrated spray applied by nozzle and mist-blower reduced the numbers of mines per leaf to 0·9, 2·8 and 4·2, respectively, as compared with 22·1 on unsprayed plants, and resulted in yields of 351, 304 and 306 bushels marketable tubers per acre; all treatments gave complete control of Aphids. Tomato plants received the dilute spray and the mist-blower concentrated spray at its normal concentration and twice this in 1951–52 and the dilute spray and concentrated sprays applied by mist-blower and nozzle in 1952–53. All sprays caused considerable reductions in numbers of leaf mines and in percentages of fruits injured, with little difference between treatments, although the dilute spray resulted in the highest yield.

Menke (H. F.). **Repellency of Toxaphene Dust and Parathion Spray to *Nomia melanderi* in blossoming Alfalfa.**—*J. econ. Ent.* **47** no. 3 pp. 539–540, 2 refs. Menasha, Wis., 1954.

In a test in which a dust containing 15 per cent. toxaphene was applied in the early morning at 30 lb. per acre to flowering lucerne growing within 500 ft. of a large nesting site of the native bee, *Nomia melanderi* Ckll., in the Yakima Valley, Washington, bee-population and tripping records showed little change from six hours to three days after application, possibly because the bees were so numerous as to mask repellency.

In a second test in an isolated part of the valley, flowering lucerne was sprayed with 10 oz. actual parathion in 5 U.S. gals. water per acre, applied from an aeroplane at 6 p.m. on 2nd August. There was no activity at the nesting sites of *N. melanderi* along the edges of the field after 5 p.m., so that bees were probably not poisoned by direct contact. Dead bees and tunnel entrances were counted in plots in the nesting area, and the tunnel entrances closed, on the 2nd, 3rd and 4th August, and averages of 7, 36 and 18 dead bees and of 126, 120 and 78 inhabited nests were found on the three days. Since observations showed that there was considerable mortality but extensive tripping in the treated field, it appears that parathion did not repel the bees significantly.

Parencia jr. (C. R.), Cowan jr. (C. B.) & Davis (J. W.). **Insecticides for Cotton Leafworm Control in 1952 and 1953.**—*J. econ. Ent.* **47** no. 3 pp. 541–542. Menasha, Wis., 1954.

Alabama argillacea (Hb.) was of minor importance on cotton in central Texas in 1952 and 1953, but insecticides were tested against damaging infestations in occasional fields late in each season. In emulsion sprays applied at 6 U.S. gals. per acre in August 1952, 0·125 lb. parathion and 0·16 lb. Metacide [parathion and methyl-parathion] per acre gave complete mortality of the larvae in 24 and 48 hours, respectively, and 1·5 lb. toxaphene, 0·2 and 0·3 lb. endrin or isodrin and 0·125 and 0·25 lb. EPN [ethyl p-nitrophenyl thionobenzenephosphonate] all gave good immediate control, 0·3 lb. isodrin being slightly better than 0·2 lb.; 0·125 lb. EPN was ineffective after five days, whereas toxaphene and 0·2 lb. endrin still gave 93 and 58 per cent. control, respectively, after six.

In August 1953, emulsion sprays of 0·25 lb. parathion and 0·3 lb. endrin in 6 U.S. gals. per acre gave complete mortality in 48 hours, 2·25 lb.

toxaphene, 0·2 lb. endrin and 0·375 lb. chlorthion (O,O-dimethyl O-3-chloro-4-nitrophenyl thiophosphate) were almost as effective, and 1·5 lb. toxaphene and 0·25 lb. chlorthion were only slightly less so. When followed by rain, applications of 2·25 lb. toxaphene and of 0·3 lb. γ BHC with 0·5 lb. DDT in 7·5 U.S. gals. emulsion spray per acre were much more effective than similar quantities of the same materials in dusts with sulphur, and a spray of 0·3 lb. endrin in 7·5 U.S. gals. gave outstanding control. Under both favourable and unfavourable weather conditions in September, heavy dust applications of 20 per cent. toxaphene with 40 per cent. sulphur and of 3 per cent. γ BHC, 5 per cent. DDT and 40 per cent. sulphur were less effective than lighter ones of calcium arsenate, which gave almost complete control in 48 hours under good conditions.

Gaines (R. C.). **Effect on Beneficial Insects of several Insecticides applied for Cotton Insect Control.**—*J. econ. Ent.* **47** no. 3 pp. 543–544. Menasha, Wis., 1954.

A table is given showing the numbers of predacious insects and spiders found at intervals from 15th June to 21st August in cotton fields receiving insecticidal sprays for the control of insect pests. Dusts of 20 per cent. toxaphene, of 1·5 per cent. dieldrin with 5 per cent. DDT, and of 3 per cent. γ BHC with 5 per cent. DDT, all with 40 per cent. sulphur, and the last mixture with calcium arsenate, were applied by aeroplane against *Psallus seriatus* (Reut.) at 8 lb. per acre on 7th July and against *Anthonomus grandis* Boh. at 10–15 lb. per acre ten times at intervals of 4–5 days from 28th July to 3rd September, all treatments giving effective control. The application on 7th July greatly reduced the predators, and though these increased again considerably before the next application, they were practically eliminated by the third, fourth and fifth.

Box (H. E.). **Informe sobre las plagas insectiles que atacan a la caña de azúcar en México, a base de un viaje de reconocimiento efectuado durante mayo-julio, 1952, a las regiones cañeras: I—Sinaloa, VI—Balsas, VII—Tehuacán, VIII—B—Papaloapan, XII—Veracruz central, XIII—Costa de Veracruz y XIV—Huasteca.** [Report on the Insect Pests that attack Sugar-cane in Mexico, based on a Survey carried out in May–July 1952 in the Cane Regions of Sinaloa, Balsas, Tehuacán, Papaloapan, central Veracruz, coastal Veracruz and Huasteca.]—*Bol. azuc. mex.* no. 44 suppl., 26 pp., 7 figs. [Mexico] 1953.

An account is given of a further entomological survey of sugar-cane areas in Mexico [*cf. R.A.E.*, A **39** 431] carried out in May–July 1952 in the States of Guerrero, Morelos and Puebla in the south, Sinaloa in the west, and Veracruz, San Luis Potosí and Tamaulipas in the east. Primary attention was given to the moth-borers (species of *Diatraea* and related genera) that attack the crop, and maize and wild grasses were included in the survey. Based on this and the earlier work, a list of the moth-borers is given, with notes on their distribution in Mexico, their food-plants and parasites, and their economic importance, the species dealt with including, in addition to those already noticed [*loc. cit.*], *D. muellerella* Dyar & Heinr., which occurred in Guerrero and Morelos and attacked maize and also sugar-cane, *D. postlineella* Schaus, a single male of which was reared from maize in Veracruz, an undescribed species of *Diatraea* referred to as A, which was observed in Veracruz and attacked sugar-cane and *Paspalum* spp., and a species identified as *Xubida dentilineatella* (B. & McD.), larvae

of which were found boring in sugar-cane and wild grasses in Veracruz. The larvae of *D. muellerella* were parasitised by *Paratheresia claripalpis* (Wulp) and to a lesser extent by *Zenillia* (*Palpozenillia*) *palpalis* Aldr. and might prove a profitable source of these parasites for laboratory rearing. *D. schausella* Dyar & Heinr., not previously recorded from Mexico, was taken on *Setaria poiretiana*, and *D. evanescens* Dyar on *Paspalum* spp., both in Veracruz.

Of the species already noticed, *D. considerata* Heinr. is the most important on sugar-cane. Though damage at Villa Unión, Sinaloa, was less extensive in 1952 than in 1951 [*cf.* **39** 432], 50 per cent. of the hearts were killed in a plantation of over 2,000 acres at Costa Rica, Sinaloa, and attack on a similar scale was reported from Culiacán in the same State. *D. considerata* was taken occasionally on maize and once on *Tripsacum lanceolatum*, but its original food-plant is unknown. *D. magnifactella* Dyar is important on sugar-cane in some areas and controlled by parasites in others. It was taken occasionally on maize and wild grasses. *D. grandiosella* Dyar attacked sugar-cane in northern Sinaloa, but was confined to maize elsewhere. Infestation by *D. saccharalis* (F.), which attacks both sugar-cane and maize, mainly in the south and east, was considerably lower than in 1951, *D. magnifactella* predominating in the areas in which the two species occurred together. The wild grasses examined are shown in a list with records of the species found attacking them.

A list is also given of the Hymenopterous and Dipterous parasites of the larvae, with notes on their local distribution, hosts and importance. They include *Apanteles diatraeae* Mues. and *Paratheresia claripalpis* from *D. saccharalis*, *D. grandiosella*, *D. lineolata* (Wlk.) and *D. muellerella* on maize, and *D. saccharalis*, *D. magnifactella* and *Diatraea* sp. A on sugar-cane, and *P. claripalpis* also from *D. considerata*, *D. grandiosella* and *Chilo loftini* Dyar on sugar-cane and *Diatraea* sp. A on *Paspalum* spp. The three races of *Paratheresia claripalpis* taken in Mexico and their host preferences are shown. *C. loftini* is parasitised by *Chelonus sonorensis* Cam. on maize and sugar-cane and by two unidentified species of *Mallochia* and one of *Mesostenus* on sugar-cane. A species identified as *Spilochalcis dux* (Wlk.) was found parasitising *D. grandiosella*, *D. lineolata* and probably *D. muellerella* on maize, *D. considerata*, *D. magnifactella* and *Diatraea* sp. A on sugar-cane, and the last and also probably *D. magnifactella* on *Paspalum*. *Zenillia palpalis* attacked *D. muellerella* on maize, *D. considerata* and *D. magnifactella* on sugar-cane, and *D. magnifactella* and *Diatraea* sp. A on *Paspalum* spp.

Other pests found included the weevil, *Cholus morio* Champ., which caused considerable damage to sugar-cane near Mexico City. The eggs are laid in the growing point, and the injury caused by the entry of the ovipositor results in the formation of dead-hearts. Damage was also severe at a place in Morelos, where 75 per cent. of the plants in a large plantation showed dead-hearts, half caused by *D. magnifactella* and half by *C. morio*. *Aeneolamia postica* (Wlk.) and related froghoppers were collected in numerous districts, mainly on wild grasses growing between cane plantations but also on the sugar-cane itself, on which they are of potential importance. *A. varia saccharina* (Dist.) was well controlled by dusting with BHC. *Sipha flava* (Forbes) occurred throughout the sugar-cane areas, and the first two generations damaged the crop. Subsequent increase was usually checked by predacious Coccinellids and Chrysopids. Of these natural enemies, the Coccinellids, *Cycloneda sanguinea* (L.) and *Ceratomegilla* (*Coleomegilla*) *maculata* Deg., were the most important, and in central Veracruz, from which *Ceratomegilla* was absent, attack was more severe, and the release of this predator is recommended. The larvae of

Lachnosterna (*Phyllophaga*) spp. caused severe damage to the underground parts of sugar-cane, and investigations on their bionomics are desirable. Detailed recommendations for work in 1952–53 are appended.

Guagliumi (P.). **El saltahoja de la caña de azúcar** *Saccharosydne saccharivora* **Westw. y la fumagina en Venezuela.** [The Sugar-cane Leafhopper, *S. saccharivora*, and Sooty Mould in Venezuela.]—*Bol. téc. Inst. nac. Agric. Venez.* no. 7, 82 pp., frontis. 15 pls., 5 pp. refs. Maracay, 1953. (With a Summary in English.)

Since 1946, outbreaks of *Saccharosydne saccharivora* (Westw.), which was formerly rare, have occurred on sugar-cane in Venezuela, mainly in Carabobo State [*cf. R.A.E.*, A **40** 389]. Infestation was severe in 1950–51, heavy though localised in 1952, and of minor importance in 1953. In this bulletin, the author describes all stages and the distribution of this Delphacid, gives a chronological survey of the literature dealing with it, reviews information on its food-plants, concluding that it breeds only on sugar-cane, and gives a list of its natural enemies, followed by an account of observations on its bionomics and control begun in 1950. These showed that severe outbreaks always began in February–March and reached their height in April–May, in the dry season, the insects disappearing at the onset of the rains in May–June. Development appeared to be continuous throughout the year, but numbers were low in other months, though small outbreaks sometimes occurred in October–November. Infestation frequently occurred in fields in which the soil was poorly aerated.

In the laboratory, at 23–33°C. [73·4–91·4°F.] and a relative humidity of up to 90 per cent., the egg stage and total development averaged 7 and 36 days, respectively. Pairing occurred 2–3 days after emergence, and oviposition usually began after a further 2–3 days, each female depositing about 200 eggs in 20–25 days in groups of 5–12 in slits in the lower surfaces of the leaves. In the field, the oviposition slits are rapidly invaded by the red-rot fungus, *Colletotrichum falcatum*. Both nymphs and adults usually remained close to the oviposition sites, feeding on the sap and usually causing little damage, but the sooty mould that developed on the honeydew on the lower leaves seriously interfered with transpiration and photosynthesis, killing young or weakened plants.

The eggs were parasitised by *Anagrus flaveolus* Waterh. and *Oligosita* sp. *Anagrus* attacked 20–25 per cent. of the egg-masses in April–May and gave almost complete mortality of the eggs in them; only females were reared in the laboratory. *Oligosita* was abundant in June–July and attacked 10–20 per cent. of the egg-masses, parasitising about 20–25 per cent. of the eggs in each. Nymphs and adults were parasitised by the Halictophagid, *Stenocranophilus quadratus* Pierce, the most important natural enemy of the Delphacid in Venezuela. It was most abundant in April–May, giving up to 63 per cent. parasitism in some cases, and then attacked mainly nymphs. Females predominated at the onset of the rains, however, and adults were then attacked in preference to the nymphs, the percentage parasitism averaging 36 and 6–7, respectively. The females are entirely endoparasitic, reproducing in the hosts in which they have developed, but rarely cause sterility or the death of the latter. Parasitism by the males, however, which are usually more numerous, prevents the nymphs from becoming adults and the adults from reproducing. Up to 15–20 per cent. of the adults of *Saccharosydne* were parasitised in April–May by an unidentified species of *Pseudogonatopus*. Males of this Bethylid were rare, and reproduction was almost entirely parthenogenetic. The apterous

females inserted their eggs into the abdomen of the host adult or last-instar nymph, and the combined egg and larval stages and the pupal stage lasted 10–11 and 15–16 days, respectively. Parasitised hosts were not able to reproduce but remained alive until the parasites became almost full-fed. *Pseudogonatopus* was itself frequently parasitised by *Echthrodryinus* sp. A preliminary introduction of *Pseudogonatopus* and *Stenocranophilus* into cane fields near Maracay, where they were not present, gave promising results.

A list is given of the numerous predators of the nymphs and adults of the Delphacid in Venezuela. The most important were the Coccinellids, *Cycloneda sanguinea* (L.), *C. antillensis* Crotch and *Ceratomegilla* (*Coleomegilla*) *maculata* (Deg.), the Chrysopids, *Chrysopa claveri* Navás, *C. silvana* Navás, and a species close to *C. breviata* Banks, and the Reduviids, *Zelus longipes* (L.) and *Z. nugax* Stål. An entomophagous fungus of the genus *Metarrhizium*, probably *M. anisopliae*, gave up to 13 per cent. mortality of *Saccharosydne* on some plants in February–May.

Since rather similar damage is caused to sugar-cane by another Delphacid, *Perkinsiella saccharicida* Kirk., in Hawaii and by *Pyrilla* in India, the natural enemies of all three insects are compared in tables. The interrelations of *S. saccharivora* with other sugar-cane pests in Venezuela are discussed.

In tests in 1952, BHC, aldrin and chlordane gave good results against the Delphacid, BHC causing complete mortality in 24 hours. However, the use of insecticides, which also destroy natural enemies, is advised only in isolated infestations.

It is stated in the course of the bulletin that infestation of sugar-cane by *S. saccharivora* was severe on one estate in Jamaica in 1953, this being the first outbreak reported there for many years.

Guagliumi (P.). **La " candelilla " en el arroz.** [Rice Blight.]—*Bol. Ext. Inst. nac. Agric. Venez.* no. 12, [1+] 18 [+1] pp., 1 fig. Maracay, 1954. (With a Summary in English.)

Rice is being increasingly grown in the States of Portuguesa and Barinas, in western Venezuela, and has been attacked there since 1951 by *Aeneolamia varia* (F.), which is widely distributed in the country as a pest of sugar-cane and maize. *A. varia sontica* Fennah is the commonest of the various subspecies present [*cf. R.A.E.*, A **40** 389] and infests rice over the greater part of the rice-growing area, but it is replaced to the west by another subspecies apparently undescribed. The local distribution of the latter is reviewed, and the most important of its wild food-plants is stated to be *Panicum maximum* growing close to rivers, from which it migrates to rice and also maize.

Observations on the bionomics of *A. varia* showed that the adults disappeared from the fields at the end of winter, though a few continued to develop on grasses in damp places, and the eggs aestivated in the soil, not hatching until 15–20 days after the beginning of the rains in April–May. The first adults appeared 30 days later, and the females oviposited in the soil over about 25 days. Adults of the next generation appeared 6–7 weeks later, and from that time all stages were present together. The nymphs, which suck the sap from the roots, cause little injury, but the adults of the first winter generation feed on the leaves when the rice is about to flower, causing severe chlorosis to develop about ten days after infestation, and those of the second attack the young ears, preventing their further development. Attack when the rice is mature is of little consequence.

The cultural methods of control recommended include ploughing rice-fields during summer to kill any nymphs and adults developing on the remains of the crop and to destroy the eggs in the soil, following rice with a leguminous crop that will provide no food for any nymphs that hatch from the surviving eggs, and cutting down *P. maximum* round rice-fields. Chemical control has so far not been required on a large scale, but a watch should be kept for incipient infestations and treatment applied if necessary. In tests, high adult mortality was given by dusts of 3 per cent. BHC distributed at rates of 90–135, 27–36 or 9–11·7 lb. per acre by hand, with a power duster or from an aeroplane, respectively. One or two applications should be sufficient to control adults of the first winter generation, but treatment would need to be repeated every 2–3 days during the 20-day emergence period to give effective control of the second. Insecticides applied against *Laphygma frugiperda* (S. & A.) on rice [*cf.* **43** 161] kill large numbers of adults of *Aencolamia* and also of the nymphs, since much of them falls to the ground, and a combined programme of control with dusts and sprays based on that for *L. frugiperda* is suggested.

La lutte chimique contre les hannetons et les vers blancs.—*Actualités agron.* Sér. C no. 1, 158 [+1] pp., 104 figs., 6 maps (1 fldg.), refs. Paris, Inst. nat. Rech. agron., 1954.

This book, to which 24 authors have contributed, is concerned with recent work on the control of Melolonthids, chiefly *Melolontha melolontha* (L.), in France [*cf. R.A.E.*, A **42** 246]. An introductory chapter deals with the importance of this species as an agricultural pest and reviews, largely from the literature, aspects of its bionomics that influence chemical control [*cf.* **37** 63]. Five chapters are devoted to detailed accounts of large-scale experiments and campaigns carried out against the adults and larvae in various parts of the country since 1946 [*cf.* **41** 129], and two others contain descriptions of the behaviour of the adults in various districts, accounts of work on the toxicity of BHC and its derivative, polychlorocyclane sulphide (S.P.C.), to the adults, the amount of deposit obtained by different methods of application, and the persistence of these insecticides, and discussions of the effects on larval populations of operations directed against the adults and of treatment against them with BHC and polychlorocyclane sulphide on honey bees, other insects, and domestic and wild animals. Practical considerations relating to chemical control, its cost, and problems of organisation are discussed in a concluding chapter, and there is a bibliography to the more important work on Melolonthids and their control in other countries.

In the experiments described, the insecticides were applied as dusts, sprays, atomised sprays and fogs by means of hand and power equipment, aeroplanes and helicopters; the various formulations and types of equipment are complementary and could be used in turn to advantage. BHC and polychlorocyclane sulphide gave excellent results against both adults and larvae. Very good control was obtained in one experiment in which dusts of BHC, polychlorocyclane sulphide or polychlorocyclane trithiocarbonate (T.T.C.) were applied to the soil in spring to destroy the emerging adults and to the vegetation on neighbouring waste land five days after the first emergence, when, in addition, hedges and bushes were dusted with BHC and fruit trees sprayed with DDT, to destroy adults congregating on them to feed.

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